1910.

NEW ZEALAND.

DEPARTMENT OF LANDS:

STATE NURSERIES AND PLANTATIONS

(REPORT ON).

Presented to both Houses of the General Assembly by Command of His Excellency.

SIR,— Department of Lands, Wellington, 31st May, 1910.

I have the honour to submit herewith the combined reports of the Superintending Nurserymen on the State-forest nurseries and plantations under their supervision for the financial year ended 31st March last. The whole position having been carefully explained by these officers in their reports, it will be unnecessary for me to supplement their remarks to any extent, because they have already been generally referred to in Lands Report already laid by you before Parliament. But a brief review of the work actually accomplished since the initiation of the Forestry Branch of this Department may not be out of place.

I have, &c.,

WILLIAM C. KENSINGTON,
Under-Secretary for Lands.

The Right Hon. Sir Joseph G. Ward, P.C., K.C.M.G.,
Minister of Lands and Commissioner of State Forests.

BRIEF REVIEW OF OPERATIONS.

RAISING OF TREES AND OUTPUT FROM NURSERIES.

A GOOD measure of success has been achieved at each of the nurseries, and the number of seedling trees raised during the year is estimated at 12,412,410. This number is rather more than a million and a quarter in excess of the previous year's results, and, although the success or otherwise of the seedling crop is usually attributed to the climatic conditions, and also to the quality of tree-seeds obtained, yet it is evident that much care and discretion have been used in accomplishing such a favourable record.

The total number of seedling trees produced since the establishment of forestry operations now reaches 76,757,658, representing an estimated value of £140,777, whilst the total cost of the operations has been £185,983 to date.

The five nurseries at present contain 23,269,265 trees, of ages ranging from one to four years, and the continuation of an output on the present basis may be anticipated.

The output of trees from these five nurseries is assuming larger dimensions, and during the past twelve months 8,292,645 trees, valued at £17,765 2s. 11d., were transferred to plantations for permanent planting. This statement reveals an advance of over a million trees on the previous year. The total output to plantations since the year 1896 is 50,545,775 trees, and their value is computed at £113,362 17s. 7d.

The difference between the total number of trees raised in nurseries and that transferred to the plantations, of about 2,500,000 plants, is accounted for by the distribution of plants to local bodies, creation of shelter-belts in nurseries, and losses of seedlings due to the ravages of the grass grubs.

Trees Planted on New Area.

Planting operations at the various plantations were vigorously prosecuted, and it was necessary to make provision for dealing with over half a million more trees than in the preceding season.

Some little difficulty was experienced in the South Island (where casual work is usually plentiful in the spring time) in obtaining the required labour for tree-planting, and every effort will be made in the future to prepare the necessary pits before the advent of the actual planting period.

Of the 8,292,645 transferred from the nurseries, 6,811,824 trees, as per Schedules 4 and 5, were planted on new areas at the eight plantations, and occupy an extent of 2,698 acres, whilst 1,480,821 were used to replant previous failures at the various plantations.

The total area now under forest trees amounts to 14,831 acres, containing 33,901,526 trees.

Prison and Free Labour.

From the reports of the officers in charge of stations where prison labour has been introduced, it will be noticed that highly satisfactory results have been attained.

The prisoners generally have taken a decided interest in all branches of the work, and the high percentages obtained in the growth of the trees planted is a sufficient proof of the excellence of the work performed.

An average of 52·23 prisoners per working-day were employed, and the value of their labour is estimated at £4,771 7s. 10d.

In the Whakarewarewa Plantation the camp was removed to a new site at Rotokakahi, and at the present rate of progress there should be a sufficient area for systematical working in this locality for at least five years.

At Waiotapu 2,679,525 trees were planted on new area by the 27·81 prisoners engaged, and this number was supplemented by a total of 773,200 trees, which were dealt with by the free labour employed in conjunction with the prisoners. A reference to the extended operations proposed for Waiotapu will be found in the Lands Report.

At Hanmer Springs, in Canterbury, a somewhat smaller gang was retained to cope with the 918,826 trees, but in this case also it was necessary to employ an average of 9·59 free workers to complete the work in season. An area of 1,080 acres adjoining the block at present being operated upon at Hanmer was resumed out of the adjoining run, and the bulk of the coming season's tree-planting will be conducted on this extension. The close proximity of the newly acquired area to the present prison camp does not justify any expenditure being devoted to the removal of buildings. If, however, the block is still further extended, it would be advantageous to remove the camp to a more central position; but in any case this will be quite unnecessary for at least three years, by which time the present available area should be planted.

Free labour has been used exclusively at Conical Hill (Otago) Plantation in dealing with 1,417,700 trees, whilst at Dusky Plantation, also in Otago, only three men were required to carry on the general maintenance labour.

Expenditure and Economy.

The expenditure for the year amounted to £22,244 2s., and the total outlay on nurseries and plantations since their initiation is £185,983 0s. 10d. Up to the present it has been impossible to prepare reliable statements of plantation assets, but every effort will be made during the ensuing year to inaugurate a system of valuation that will be applicable to each of the stations.

An outstanding feature of the year's operations, and which may rightly be reviewed with satisfaction, has been the earnest attempts by the officers to promote general economy in all transactions where such could be introduced without affecting the efficiency of the work. Since the inception of afforestation work in the Dominion, the individual knowledge gained has been diffused freely amongst officers generally, and it is only to be expected that the introduction annually of advanced methods in connection with the work will gradually enable the Department to undertake the creation of forests on the most economical and modern lines. The progress in this direction may be gleaned from the fact that the expenditure for the year under review was considerably below that of preceding year, notwithstanding the increased amount of work performed.

It is obvious from the report on Conical Hills Plantation that planting by the "dibbling" system may be carried on with every probability of success on at least a portion of the areas worked at the southern stations, and as this method has proved immensely cheaper, and an excellent substitute in certain classes of ground for pitting and planting, provision is being made to continue the practice. As the nurseries have reached a high standard, and possess the necessary buildings, implements, &c., for systematic working, a still greater proportion of expenditure may now be allocated to the actual raising and planting of trees. It must, however, not be overlooked that when the afforestation scheme was commenced in New Zealand a large expenditure was incurred in experimental work, and from which the full benefits are now being derived.

Assistance to Institutions, etc.

Repeated requests for general information on tree-planting matters have been attended to with promptitude, although it occasionally happens that pressure of duties forbids the officers entering into details of the subject to the desired extent.

At the special request of the Education Department an officer will, at a convenient period, visit the Burnham Industrial Schools, and demonstrate to the boys the work of tree raising and planting in its various stages. The management of the institution recognise the importance of timber-production for their own requirements, and by receiving practical information on the subject, they will be able to not only add another healthy and profitable occupation to their syllabus, but also be in a position to assist other similar institutions by donations of cheaply grown trees.

GENERAL.

An interesting article on tree-growing at Whangarei and Rotorua has been compiled by the Superintending Nurseryman for the North Island (Mr. Goudie), and appears in Appendix D, and in next year's report a detailed article on the southern stations will be similarly presented by the officer in charge of the South Island.

In the following summaries the operations for the year are disclosed :—

APPENDIX A.

TABLE A.— SUMMARY OF RESULTS, 1909–10.

Nursery or Plantation.	Number of Trees raised, 1909–10.	Total Number of Trees raised, 1896 to 1910.	Values of same.	Number of Trees in Nurseries or Plantations at 31st March, 1910.	Number of Trees planted on New Area, 1909–10.	Area planted in 1909–10.	Total Area planted at 31st March, 1910.
			£ s. d.			A. R. P.	A. R. P.
Rotorua Nursery ..	5,761,535	37,192,644	68,591 13 1	9,797,435	..	..	..
Ruatangata Nursery	350,000	2,667,868	4,194 10 10	350,000	..	..	..
Eweburn Nursery ..	698,800	4,847,517	9,373 19 8	1,991,650	..	..	..
Tapanui Nursery ..	2,667,075	18,331,808	37,226 10 1	5,527,500	..	..	..
Hanmer Springs Nursery	2,935,000	10,275,531	14,249 7 7	5,602,680	..	..	..
Kurow Nursery ..	..	219,000	223 3 0	..	..	..	..
Starborough Nursery	..	3,223,290	6,918 8 11	..	..	..	..
Whakarewarewa Plantation	..	..	..	8,209,901	1,326,675	626 0 0	3,784 0 0
Waiotapu Plantation	..	..	..	12,028,059	2,932,700	1,077 0 0	4,600 0 0
Pubipuhi Plantation	..	..	..	1,613,563	125,325	104 0 0	1,616 0 0
Dusky Hill Plantation	..	..	..	2,079,550	106,158	39 0 0	845 0 0
Conical Hills Plantation	..	..	..	5,124,820	1,347,700	495 0 18	1,747 2 25
Waitahuna Plantation	..	..	..	30,525	..	..	12 1 14
Gimmerburn Plantation	..	..	..	487,695	..	..	173 1 0
Naseby Plantation ..	..	..	..	443,725	54,440	20 0 0	163 0 0
Hanmer Springs Plantation	..	..	..	3,350,056	918,826	337 2 5	1,213 2 5
Dumgree Plantation	..	..	..	350,000	..	..	469 3 0
Raincliff Plantation	..	..	..	50,000	..	..	206 3 0
Domains, reserves, &c.	..	..	..	133,632	..	..	..
Totals ..	12,412,410	76,757,658	140,777 13 2	57,170,791	6,811,824	2,698 2 23	14,831 1 4

TABLE B.—SUMMARY OF EXPENDITURE AND VALUES.

Name of Station.	Expenditure for Year ending 31st March, 1910.	Expenditure from September, 1896, to 31st March, 1910.	Value of Stock and Improvements for Year ending 31st March, 1910.	Value of Stock, Improvements, &c., from September, 1896, to 31st March, 1910.
	£ s. d.	£ s. d	£ s. d.	£ s. d.
Rotorua Nursery	3,617 2 0	34,235 6 10	13,626 3 9	22,880 4 5
Ruatangata Nursery	872 9 7	8,316 16 10	330 10 8	3,847 6 4
Eweburn Nursery	769 17 11	11,081 13 5	3,720 18 6	8,636 3 6
Tapanui Nursery	1,801 5 2	19,071 10 1	8,737 10 4	16,549 14 2
Hanmer Springs Nursery	1,323 6 1	6,837 7 9	9,666 9 11	12,163 3 4
Kurow Nursery	..	3,070 2 7	*	*
Starborough Nursery	..	9,256 7 1	*	*
Whakarewarewa Plantation	4,721 1 5	22,871 1 11	*	*
Waiotapu Plantation	1,601 17 7	8,965 16 7	*	*
Pubipuhi Plantation	1,635 6 9	8,121 18 5	*	*
Kaingaroa Plains Plantation	..	368 18 2	*	*
Dusky Hill Plantation	501 15 1	12,001 10 3	*	*
Conical Hills Plantation	2,462 1 7	14,339 13 7	*	*
Waitahuna Plantation	13 12 0	196 12 9	*	*
Gimmerburn Plantation	152 14 3	2,519 0 5	*	*
Naseby Plantation	510 16 6	2,777 9 1	*	*
Hanmer Springs Plantation	1,222 0 5	6,906 1 11	*	*
Dumgree Plantation	..	10,017 10 5	*	*
Raincliff Plantation	..	1,104 12 5	*	*
Domains, Reserves, &c.	..	431 13 1	..	..
Clerical assistance	..	739 7 8	..	..
Postages and telegrams	29 19 7	90 4 11	..	..
Management of State forests, books	1,008 16 1	2,662 4 8	..	..
Totals	22,244 2 0	185,983 0 10	36,081 13 2	64,076 11 9

* Reliable estimates of values not available.

TABLE C.—OUTPUT OF TREES FROM NURSERIES.

Nursery.	During 1909–10.		Since 1896.	
	Number.	Value.	Number.	Value.
		£ s. d.		£ s. d.
Rotorua	5,102,400	8,777 8 10	27,395,209	55,237 14 7
Ruatangata	375,587	626 10 6	1,863,832	4,646 1 4
Eweburn	199,975	532 10 2	2,764,352	6,580 9 0
Tapanui	1,574,228	4,704 2 10	11,942,311	30,972 4 2
Hanmer Springs	1,040,455	3,124 10 7	3,348,001	8,713 8 1
Kurow	...	...	172,460	278 18 6
Starborough	...	...	3,059,610	6,934 1 11
Totals	8,292,645	17,765 2 11	50,545,775	113,362 17 7

TABLE D.—MINIMUM AND MAXIMUM READINGS OF THERMOMETER (FAHRENHEIT) AND RAINFALL AT VARIOUS STATIONS FOR THE YEAR ENDING 1910.

Station.	Temperature.		Rainfall.	
	Minimum.	Maximum.	Inches.	Number of Days.
	Deg.	Deg.		
Rotorua Nursery, Auckland	24	88	76·67	173
Eweburn Nursery, Otago...	11	95	13·98	86
Tapanui Nursery, Otago	21	95	31·67	141
Hanmer Springs Nursery, Canterbury ...	20	90	43·74	139
Ruatangata Nursery, North Auckland ...	30	83	65·54	181
Waiotapu Plantation, Auckland	20	88	68·20	110

TABLE E.—AVERAGE NUMBER OF WORKMEN EMPLOYED DAILY AT THE VARIOUS NURSERIES AND PLANTATIONS DURING THE YEAR 1909–10.

Station.	Free Labour.	Prison Labour.	Station.	Free Labour.	Prison Labour.
	No.	No.		No.	No.
Rotorua Nursery	25·70	...	Dusky Hill Plantation ...	3·70	...
Ruatangata Nursery ...	5·77	...	Conical Hills Plantation ...	17·80	...
Eweburn Nursery ...	5·01	...	Gimmerburn Plantation ...	1·00	...
Tapanui Nursery	10·30	...	Naseby Plantation ...	3·00	...
Hanmer Springs Nursery ...	7·66	...	Hanmer Springs Plantation	9·59	13·53
Whakarewarewa Plantation	33·26	10·89	Waitahuna Plantation ...	0·25	...
Waiotapu Plantation ...	10·03	27·81			
Puhipuhi Plantation ...	11·03	...	Totals	144·10	52·23

APPENDIX B.

REPORT ON TREE-GROWING OPERATIONS IN THE NORTH ISLAND.

(By the Superintending Nurseryman, Rotorua.)

The operations during the past year have been very successful. In the nurseries 6,111,535 trees have been raised, and 4,384,700 trees, covering an area of 1,807 acres, have been permanently planted on the plantations. The weather conditions have generally been favourable, and, while the death-rate amongst the trees planted was low, the growth made has been in many cases greater than usual.

Prison Labour.—The employment of prison labour has again been satisfactory, and we are much indebted to the officers of the Prisons Department for their liberal co-operation in carrying on the work. At the two prison camps (Lake Rotokakahi and Waiotapu) the value of work done

is estimated at £3,953 16s. 8d., or an average value to each of the 38·70 prisoners employed of £102 3s. 4d. These figures show that the average prisoner is capable of doing nearly as much work as the average free man. Most of the prisoners, too, take an intelligent interest in the work, and watch the results obtained amongst the trees planted, all of which tend towards making the work successful.

At Waiotapu the land within working distance of the camp will all have been planted by November, 1911, and after that it will be necessary to shift the camp on to a new block of land. For this purpose an area of 20,000 acres has been set aside, and preparations are now being made for laying off a camp site, land for a kitchen-garden and horse-paddock, and erecting shelter-belts. Roughly speaking, it is not profitable to cause the prisoners to walk more than two miles and a half away from the camps, as the time taken walking to and from the work reduces the working-day very much. If a camp is set down in the centre of a square block of 3,000 acres, and tree-planting is carried on within a 2½-mile radius from the camp, it means that the whole block is planted in four years, and the camp has again to be shifted. In order to avoid shifting the camp so often, it might be desirable to erect a central camp much on the same lines as the present ones, and have smaller and more mobile camps placed at some distance from the central camp. In this way it would be possible to fix the central camp in a position where it could remain for fifteen or sixteen years.

Fire-breaks.—With a view to reducing the labour in the upkeep of the fire-breaks, which are annually becoming of greater extent, some 50 acres of fire-breaks at Whakarewarewa and Waiotapu Plantations were, last spring, sown down in grasses and clovers with good results. It is proposed to graze these areas off with sheep, and in that way secure as efficient a fire-break as if the land was kept ploughed. Until the branches of the trees interlace sufficiently to prevent sheep from getting in amongst them the fire-breaks will need to be ploughed, or have the growth burnt off regularly. This would mean, roughly, that in the case of larch it would not be possible to graze sheep on the fire-breaks until the trees were five years old, and in the case of pines seven years old.

Subdivisional Plans.—The work under this heading comprised the subdividing of Whakarewarewa Plantation, but as the Waiotapu Plantation areas have not been completed, I have been unable to complete the tables showing the areas and ages of each species of tree planted. This return will be got under way as soon as the surveying of the plantation areas at Waiotapu is completed. A surveyor has been detailed for this special work.

Discontinuance of Tree-growing in Whangarei District.

It has been decided to cease further tree-growing operations in this district, and the Ruatangata Nursery will therefore be closed on the 30th September next. The reasons that have contributed towards this decision are twofold. First, it is considered necessary, at least for the present, to concentrate the afforestation work of the North Island to one nursery, in order to make our plantations a success financially; and, second, the natural difficulties to be met with in conducting the work in this district are very numerous, and it is feared would make the work unprofitable. The difficulties referred to are such as may be expected in any district where the natural forest has been similarly exploited, and are alluded to in Appendix D.

The plantation at Puhipuhi will be left in charge of a capable officer, who will attend to such work as is necessary to protect the trees that have been planted, but no further area will be planted after this winter, the area planted to date being 1,616 acres.

Tree-growing in Rotorua District.

The growing scarcity of native timber in parts of the Dominion is every year awakening some of our landholders to the necessity of providing for the future by forming small plantations of timber trees, and this is evidenced by the number of letters received, and by visitors to the nurseries, asking for advice and information as to the best sorts to plant. In many cases it is quite impossible to state what species of trees should be planted, as the conditions of the locality must be taken into consideration in each case. In the majority of cases all that can be done is to give the applicant a list of the hardiest of the economic trees, and also some information as to the best method to adopt in planting. At most of the plantations many different species of trees have been tried, with a view of testing their suitability to the various localities, but it has been found that comparatively few sorts can be successfully grown on cleared land without protection. Again, a species that will succeed on a hillside may be badly frosted if grown in a valley or a hollow, so that local knowledge must be brought to bear in conducting all operations. For general information, it may be well to first briefly state the general conditions necessary for the successful production of timber, and then to give a brief description of the principal sylvicultural systems, and the result of the operations in this district since the work was started twelve years ago. These particulars are given in Appendix D.

H. A. Goudie,
Superintending Nurseryman, North Island.

Rotorua Nursery.

(Approximate area, 85 acres; approximate altitude, 1,000 ft.)

The measure of success obtained at this nursery during the past year is somewhat below the average, the exceptionally heavy rainfall and the weather conditions generally having retarded the growth of some of the crops.

Seedling Trees.—The number of trees raised from seed during the year is estimated at 5,761,535, and the number thus grown to date is 37,192,644. These trees have made extraordinarily good growth, which is due to the fact that they were protected by the seed-frames during the hot dry weather in December that adversely affected the lined-out trees and two-year-old seedlings which were not so protected. The larch crop, which is very fine, is smaller in number this year owing to the scarcity of feed. On the other hand, the *Pinus Laricio*, of which more seed was procured, germinated splendidly, and there is therefore an abundance of this species. *Pinus ponderosa* is a good crop in respect both to germination and growth, as are also *Pinus radiata* and *Eucalyptus Stuartiana*. Redwood germinated very sparsely, but what trees there are are nice sturdy plants. A number of other species were grown experimentally, and details of these will be found in Schedule 1 appended. Of these, the western larch (*Larix occidentalis*) deserves special mention. This species is reputed to be a very valuable timber tree, and this is the first occasion on which it has been grown here. From inquiries that have been made so far, there seems a probability that seed of this species will be somewhat difficult to procure. We are indebted to Mr. T. W. Adams, Greendale, Canterbury, for the small packet which was sown this year.

The two-year-old seedling trees have not made their usual vigorous growth, but are still of a size suitable for transferring to the plantations. The larch seedlings were much infested with the grass grub, which caused a number of trees to die off during the dry spring months. This trouble was reduced somewhat by injecting bisulphide of carbon in the parts of the seed-beds most affected, but it is a tedious undertaking to carry out this treatment over a large area of ground.

Amongst the lined-out trees the growth generally is below the average, but, on the other hand, scarcely any failures have occurred. The *Pinus Laricio* are particularly good, and the other species of pines fair, but amongst the larch the growth is very patchy. Twenty-five acres of vacant land in the nursery were, in the spring, sown down in oats and ryecorn in mixture, and resulted in about 30 tons of fairly good sheaf, which it is proposed to chaff. Horse-feed is a fairly big item in our expenditure, and this crop will therefore effect a considerable saving. The land is certainly not entirely suitable for such crops, but, even with fair results, cropping may be regarded as profitable. It is proposed to take in a further area of about 16 acres simply for growing horse-feed. The shelter plantations and hedges in the nursery have now attained to a fair height, and their influence on the crops is being felt more every year. These have enhanced the value of the property both from a utilitarian and scenic standpoint, and the grounds now attract a large number of visitors.

During last winter trees to the number of 5,102,400, valued at £8,777 8s. 10d., were sent out from the nursery (details in Schedule 4). Besides these trees, a large number of seedlings were sized and got ready for lining-out, the total number of trees actually handled in the nursery during the year being 8,300,000. The cost of the various operations was as follows: Lifting, counting, and tying into bundles cost 2s. 2d. per thousand trees; sizing seedlings cost 1s. 3d. per thousand; lining-out trees in nursery cost 1s. 7d. per thousand.

For the coming winter preparations are in hand for transferring about five million trees to the Whakarewarewa and Waiotapu Plantations. The number of trees sent out from the nursery to date is 27,395,209, and their value £55,237 14s. 7d. Details of stock in hand and trees transferred and expenditure and vaules are appended.

Vouchers dealt with during the year were 251, covering a total amount of £10,630 1s. 6d. The correspondence—Inwards, 560; outwards, 749; parcels (out), 53: total, 1,362. Official stamps used for postages and telegrams totalled £9 16s. 3d.

The following is a record of rainfall and temperature for the year (1909–10) :—

Month.	Rainfall.	Number of Days on which Rain fell.	Highest Reading of Thermometer.	Date.	Lowest Reading of Thermometer.	Date.
1909.	Inches.		Degrees.		Degrees.	
April	3·35	10	75	9th	29	13th
May	5·41	17	71	1st	25	29th
June	4·26	15	68	22nd and 23rd	25	1st and 10th
July	9·59	16	61	19th and 27th	24	14th
August	12·01	18	62	31st	24	13th
September	4·93	18	67	28th	26	5th
October	5·69	16	74	14th	31	15th
November	3·91	14	79	12th	34	8th
December	3·30	8	88	17th	40	22nd
1910.						
January	11·02	15	87	5th	42	2nd
February	7·54	8	84	23rd	46	2nd
March	5·66	18	79	18th	40	25th
Totals	76·67	173	...	...	...	...

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	30,618	4	10
Tree-growing	2,198	2	2
General maintenance and repairs	429	17	0
Nursery-formation	4	0	0
Horse-feed purchased and grown	195	15	7
Manures	125	13	0
Tree-seeds	235	13	6
Tools, implements, &c.	92	10	8
Water-supply	0	11	6
Buildings, improvements to	46	8	1
Fencing	3	15	0
Miscellaneous works	64	12	2
Clerical assistance	13	13	4
Proportion of Nurseryman's salary	162	10	0
Proportion clerk and accountant's salary	44	0	0
	£34,235	6	10

Value of Stock, &c.

	£	s.	d.	£	s.	d.	£	s.	d.
Amount at 31st March, 1909 ...				20,902	7	7			
Less value of trees	11,412	15	0						
" horse-feed in stock	235	0	0						
" tools written off during year ...	0	11	11						
				11,648	6	11			
							9,254	0	8
Trees, as per Schedule 1							5,656	15	6
" " 2							6,931	5	0
" " 3							765	18	0
Tools and implements							92	10	8
Water-supply							0	11	6
Nursery-formation							4	0	0
Fencing							3	15	0
Buildings							46	8	1
Horse-feed in stock							125	0	0
							£22,880	4	5

Summary.

	£	s.	d.
Value of present stock and general improvements	22,880	4	5
Value of trees sent out since initiation of nursery	55,237	14	7
	78,117	19	0
Expenditure to date	34,235	6	10
Credit balance	£43,882	12	2

Stock in Hand.

SCHEDULE 1.—Details of One-year-old Trees, grown at Rotorua Nursery, 1909–10. (Eleventh Crop.)

Name of Tree.	Number in Seed-beds.	Height in Inches.	Amount of Seed sown.	Value per Thousand.	Total Value.	Remarks.
			Lb.	£ s. d.	£ s. d.	
Pinus Laricio	3,000,000	2	300	1 0 0	3,000 0 0	Exceptionally good.
" ponderosa	400,000	2	50	1 0 0	400 0 0	Good.
" " (var. scopulorum)	800	2	½	1 5 0	1 0 0	"
" " teocote	6,000	2	1	1 5 0	7 10 0	Experimental; good.
" " resinosa	1,500	2	1	1 5 0	1 17 6	" "
" " Jeffreyii	3,000	3	3	1 5 0	3 15 0	Good growth.
" " radiata	200,000	6	20	1 0 0	200 0 0	Very good.
" " strobus	15,000	1	23	1 0 0	15 0 0	Sparse germination.
Sequoia sempervirens	22,000	4	38	4 0 0	88 0 0	"
Liquidambar styraciflua	2,000	6	1	1 5 0	2 10 0	Good.
Taxodium distichum	35	6	½	1 5 0	0 1 0	Very thin crop.
Thuja occidentalis	1,800	1	1	1 10 0	2 14 0	Good.
Cupressus thurifera	800	3	1	1 0 0	0 16 0	Experimental; good.
Fraxinus americana	100	4	1	1 0 0	0 2 0	" fair.
Tsuga canadensis	8,000	1	½	1 0 0	8 0 0	" good.
Larix europæa	1,750,000	1–6	392	1 0 0	1,750 0 0	Very good.
" occidentalis	500	2	¼	1 0 0	0 10 0	Slow growth.
Eucalyptus Stuartiana	350,000	4	9	0 10 0	175 0 0	Very good.
Totals	5,761,535	..	..	..	5,656 15 6	

SCHEDULE 2.—Two-year-old Trees, grown at Rotorua Nursery, 1908–9. (Tenth Crop.)

Name of Tree.	Number in Seed-beds.	Number in Nursery Lines.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
				£ s. d.	£ s. d.	
Larix europæa	1,600,000	500,000	9–12	1 5 0 / 2 5 0	3,125 0 0	The growth made by all the two-year-old trees is much less satisfactory than usual.
Pinus Laricio	..	1,300,000	4	2 5 0	2,925 0 0	
„ ponderosa	..	280,000	3	2 5 0	630 0 0	
„ „ (var. Benthamiana)	..	80,000	3	2 10 0	200 0 0	
„ Murrayana	..	1,000	4	2 5 0	2 5 0	
Pseudo-tsuga taxifolia	..	17,000	5	2 10 0	42 10 0	
Thuja gigantea	..	1,300	3	3 0 0	3 18 0	
Alnus glutinosa	..	1,300	6	2 0 0	2 12 0	
Totals	1,600,000	2,180,600	..	..	6,931 5 0	
	3,780,000					

SCHEDULE 3.—Three-year-old Trees, grown at Rotorua Nursery, 1907–8. (Ninth Crop.)

Name of Tree.	Number in Nursery Lines.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
			£ s. d.	£ s. d.	
Larix europæa	240,000	9–12	3 0 0	720 0 0	Growth less than usual.
Pinus Laricio	12,000	5	3 0 0	36 0 0	
„ strobus	3,300	3	3 0 0	9 18 0	
Totals	255,300	..	..	765 18 0	

SCHEDULE 4.—Trees transferred from Rotorua Nursery to Forest Plantations, &c., 1909–10.

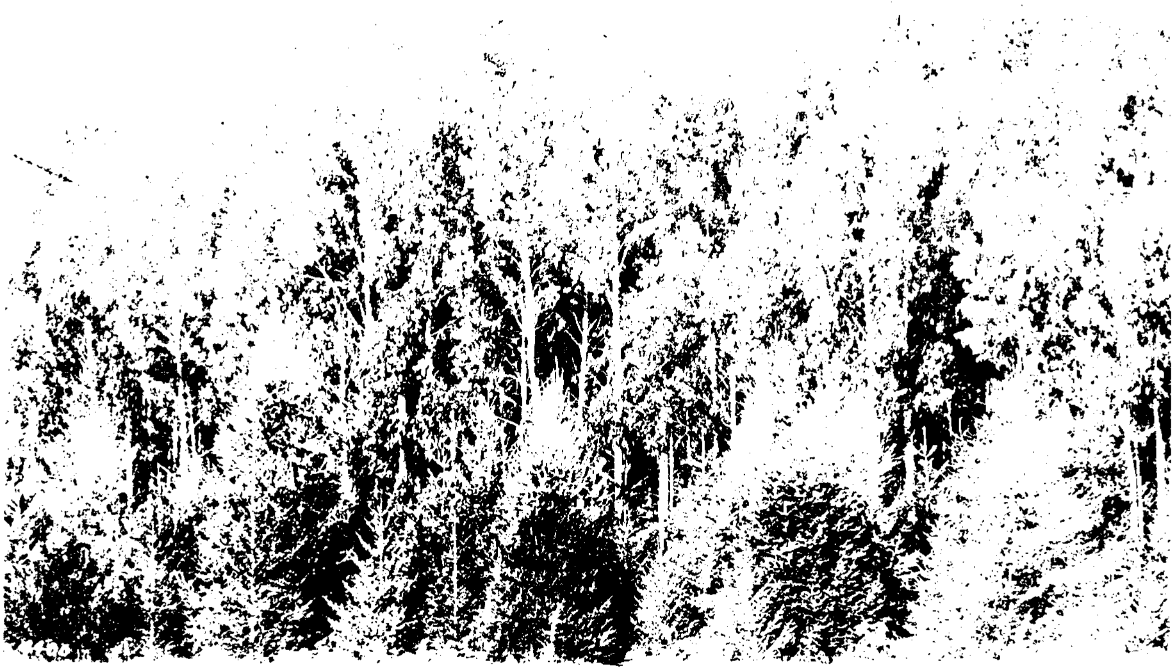
Where sent.	Name of Tree.	Number.	Value per Thousand.	Total Value.	Remarks.
			£ s. d.	£ s. d.	
Waiotapu Plantation	Pinus austriaca	16,325	3 0 0	48 19 6	Results are more than ordinarily good.
	„ Laricio	532,125	1 5 0	665 3 1	
	„ „	3,875	2 5 0	8 14 5	
	„ „	18,450	3 0 0	55 7 0	
	„ ponderosa	30,725	2 5 0	69 2 7	
	„ „ (var. Benthamiana)	96,325	2 10 0	240 16 3	
	„ strobus	14,750	1 5 0	18 8 9	
	„ „	25,500	3 0 0	76 10 0	
	Larix europæa	985,500	1 5 0	1,231 17 6	
	„	1,435,250	2 5 0	3,229 6 3	
	„	223,500	3 0 0	670 10 0	
	Sequoia sempervirens ..	20,400	6 0 0	122 8 0	
	Pseudo-tsuga taxifolia ..	50,000	2 10 0	125 0 0	
Totals ..	..	3,452,725	..	6,562 3 4	
Whakarewarewa Plantation	Pinus Laricio	107,250	2 5 0	241 6 3	Very good results.
	„ ponderosa	34,300	2 5 0	77 3 6	
	Eucalyptus Stuartiana ..	396,575	0 10 0	198 5 9	
	Sequoia sempervirens ..	1,650	4 0 0	6 12 0	
	„ ..	3,925	6 0 0	23 11 0	
	Larix europæa	821,000	1 5 0	1,026 5 0	
	„	278,000	2 5 0	625 10 0	
	Pseudo-tsuga taxifolia ..	6,100	2 10 0	15 5 0	
Totals ..	..	1,648,800	..	2,213 18 6	

H. A. GOUDIE,
Superintending Nurseryman, North Island.

WAIOTAPU PLANTATION.

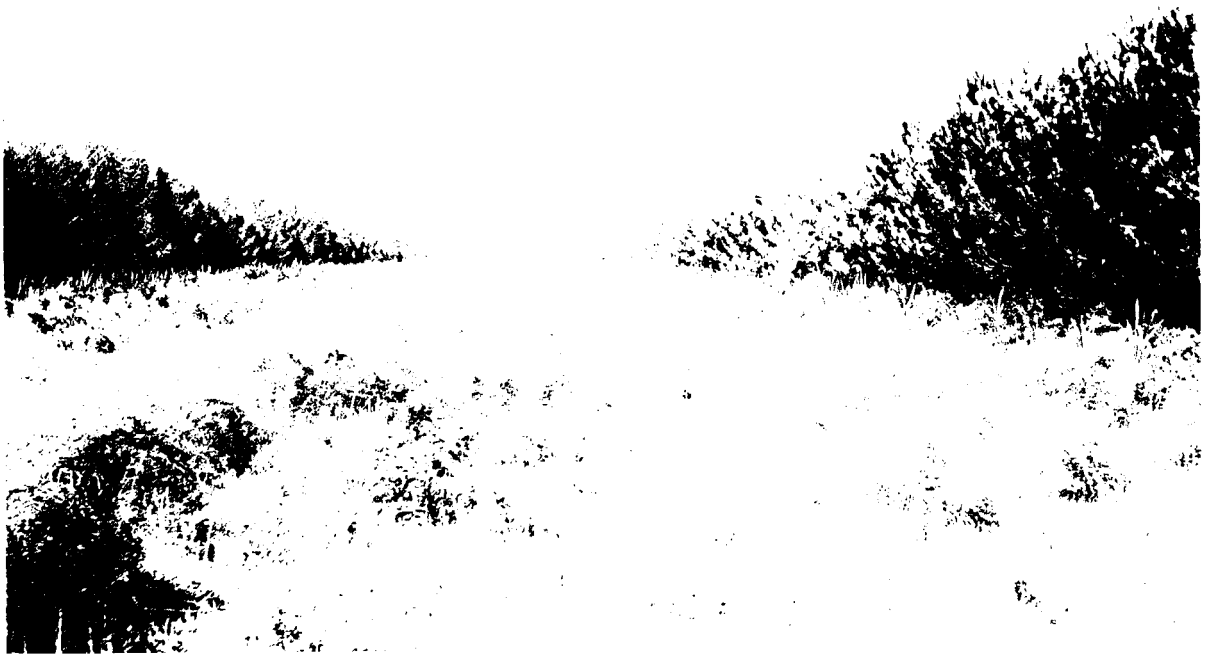
(Approximate area, 6,700 acres; approximate altitude, 1,200 ft.)

Trees planted during the past year amounted in all to 3,452,725. Of this number, 2,932,700 were planted on a new area of 1,077 acres, and the balance of 520,025 were used to replace failures in former plantings. This plantation now contains 12,028,059 trees, covering an area of 4,600 acres.



Eucalyptus Plantation, Whakarewarewa

Experimental Plantation, Kaingaroa Plains



The work has been done partly by prison labour and partly by free labour, the latter being employed on the remote parts of the block that could not be profitably worked from the prison camp. Of the 3,452,725 trees planted, the prisoners planted 2,679,525, and the free labour 773,200.

All the trees planted here last year have done well, the growth made by the different species being up to the average of former years. 50,000 Douglas fir were planted at 16 ft. apart among the larch. The Douglas fir appears to be doing better at this early stage among the larch than the redwood. After due consideration it is questionable if it is a wise policy to plant redwood here, as it is not giving very satisfactory results even in the older parts of the plantation. It appears to grow well where sheltered, but afterwards the larch grows too fast for it, and eventually suppresses it entirely. *Pinus strobus* and *Pinus ponderosa* continue to do well. The larch in the older part of the plantation have put on a phenomenal growth, owing to the absence of frost. Pruning has been attended to, and the question of thinning-out will have to be faced in the near future. Some of the hill-tops of pure pumice were planted some years ago with *Robinia pseudo-acacia*. This species has not done well except where sheltered, and the failures amongst them have been replaced with larch, *Pinus austriaca*, or *Pinus Laricio*. The following trees, in the order named, appear to be the ones best suited for planting at Waiotapu: Larch, *Pinus Laricio*, *P. ponderosa*, *P. strobus*.

The fire-break on the boundary adjoining the Rainbow Mountain Reserve and Run No. 79 was continued, three miles by 1 chain wide being cleared, stumped, ploughed, and disced. This is considered an efficient safeguard at this particular part of the reserve. Another fire-break running diagonally to the above one was formed, being a mile long and 1½ chains wide, while another 1 mile 3 chains in length and 1½ chains in width was formed to protect the trees between the prison camp and the Galatea Road. The total area for the year used for fire-breaks is 50 acres. Twenty acres of fire-breaks in the older parts of the plantation was sown down with grass as an experiment, and will be grazed with sheep later on.

A further area of 50 acres will have to be attended to in the same manner next year, as the area of fire-breaks now under cultivation is becoming too large to permit of them all being kept cultivated.

The eucalypti which were planted experimentally from 1902 to 1905 have in many cases failed miserably, owing to the unseasonable frosts. Several areas under this class of tree were replanted with larch, which have done well, and during the coming winter it is proposed to entirely restock the eucalypti areas that have failed with larch or *Pinus Laricio*.

In order to facilitate the distribution of trees this next winter, a road has been formed from the prison camp on to the land to be planted. This road is so situated that it will probably be much used later on when the tree-planting camp is removed in the direction of the Kaingaroa Plains. The preparations for the coming winter's work are well forward. 1,200 acres have been cleared and burnt off, and two million pits dug by prison labour. The free-labour gang have also made preparations for planting 500,000 trees, and it is expected that between the free and prison labour something like three million trees will be planted. Judging by the present rate of the tree-planting work, the present enclosure will be completed about November, 1911, and it will then be necessary to shift the prison camp on to another block of land. Vast areas of land suitable for this work are obtainable on the Kaingaroa Plains, and it is proposed to make the next remove in that direction. In anticipation of this, an area of perhaps 50 acres will be enclosed with a post-and-wire fence and shelter-belts of pines, and sown down with grass.

The value of work done by prison labour during the year was £3,164 19s. 2d., or an average for each of the 27·81 prisoners of £113 16s.

The thanks of the Department are again due to the Prisons Department's officers for the able assistance given in carrying out the various works.

Details of expenditure are appended.

Following is a record of rainfall and temperature for the year:—

Month.	Days Rain fell.	Amount of Rain.	Minimum Temperature.	Maximum Temperature.
1909.		Inches.		
April	5	2·03	29	72
May	12	4·93	25	69
June	9	4·00	24	63
July	12	7·42	21	62
August	13	11·87	20	63
September	13	4·64	23	69
October	10	4·83	27	73
November	8	2·93	33	80
December	6	2·28	38	84
1910.				
January	8	7·60	43	88
February	6	9·97	43	85
March	8	5·70	36	80
	110	68·20		

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	7,363	19	0
Pitting	117	1	9
Tree-planting	164	12	0
Clearing	209	15	6
Cartage of trees	88	9	6
General upkeep of plantation	374	10	11
„ repairs	4	18	3
Horse-feed purchased and grown	60	10	5
Fencing	80	12	0
Tools, implements, &c.	44	7	1
Formation	63	0	2
Salaries—			
Supervision of prison labour	265	0	0
„ free labour	50	0	0
Nurseryman's proportion of	35	0	0
Proportion of clerk and accountant's salary	44	0	0
	£8,965	16	7

R. MacRae, Plantation Foreman.

Whakarewarewa Plantation.

(Approximate area, 8,912 acres; approximate altitude, 1,200 ft.)

During the past year trees to the number of 1,648,800 were received from Rotorua Nursery. Of this number, 1,326,675 were planted on a new area of 625½ acres, 271,875 were used to replace failures in former plantings, and 50,250 to replace failures in the autumn planting of eucalyptus. The total number of trees planted out to date is 8,209,901, occupying an area of 3,784 acres.

Prison Labour.—The prison camp was shifted to a new site at Lake Rotokakahi at the end of June, practically all the work in connection with shifting being done by prisoners. Four months previous to shifting one officer was sent out with eight men, who levelled the site and erected the buildings, which comprise a commodious kitchen, officers' mess-room, store-room and office, a workshop, and a wash-house. A garden was also formed, and a horse-paddock cleared, fenced, and sown down in grass, with excellent results, there being now plenty of feed. The camp is supplied with water from the lake, from which it is pumped up by a windmill to a concrete tank behind the kitchen. Owing to the shifting of the camp, no pitting or planting was done by the prisoners, and they have been chiefly employed clearing for tree-planting, clearing fire-breaks, and forming roads and sledge-tracks.

The daily average number of men employed was 10·89, and their work was valued at £789 7s. 6d., or an average per man of £72 10s. 10d. The land round the present camp will probably provide employment for prisoners for the next five years.

Free Labour.—An average daily number of 33·26 men were employed, and the average cost of the various works undertaken was as follows: Clearing for tree-planting, £2 3s. 4d. per acre; pitting, 11s. 4¼d. per thousand; tree-planting, 7s. 9¼d. per thousand; and replacing blanks, 14s. 5d. per thousand. As the ground is rough and the natural growth very heavy, temporary fire-breaks 1½ chains in width have to be formed round the blocks before they can be burned off, and this adds considerably to the cost of clearing. The quantity of stumps and roots also makes pitting much more difficult. The portion of the block being dealt with at present is the roughest part of the enclosure, being steep and densely covered with fern. Pits to the number of 1,341,000 were prepared, about 15,000 of which are left available for next season's planting. The chief items in maintenance work were clearing of growth amongst the younger trees and the upkeep of fire-breaks. A small amount of pruning was also done amongst the older gums. 8,312 fencing battens were split in the bush from dead rimu trees, at a cost of 7s. 9d. per hundred.

Convalescent Consumptives.—One hundred and fifty-three and a quarter acres of the lighter portion of the clearing for tree-planting was done by the Karere Camp convalescent consumptives, at £1 per acre. After the clearing the men were employed planting, at 8s. per thousand trees. The daily average number of men employed was 7·65, and their total earnings amounted to £515 19s. 5d. At the end of the planting season, there being no suitable work available, it was decided to close the camp for about four months, at the end of which time the men would again be given employment.

A house for the forester was erected on the site of the old prison camp, the buildings, consisting of kitchen and storehouse, being utilised for this purpose. By placing them together, and building a new portion on to them, a very comfortable little cottage was made.

The results of the year's tree-planting operations are very satisfactory. The species chiefly planted were *Larix europæa* and *Eucalyptus Stuartiana*, both of which have done very well. Very few failures occur in the larch, and scarcely any replanting will require to be done. *Eucalyptus Stuartiana*, which until the last year were planted in the spring, were this year planted in the autumn without mossing. Although there may be a slightly greater percentage of failures, this method is to be recommended on account of its cheapness. Mossed plants require to be carted and distributed in boxes, which entails a considerable amount of labour, especially on rough country. *Pinus Laricio* and *P. ponderosa* were used for replanting blanks in former planting. Both species of all ages are doing very well, and are both suitable trees for planting in this district. A small

number of redwood were planted in sheltered position on the shores of Lake Rotokakahi, where they have made better progress than any of the former plantings of this species. A small quantity of Oregon pine was also planted rather late in the season, the number of deaths being above the average. Throughout the plantation the trees have made vigorous growth, many of the larch planted four years ago having gained as much as 6 ft. in height; and the spruce also, which for two years were almost at a standstill, have come on very well, and give promise of ultimately becoming a fine crop. Preparations are now well in hand for the coming season, when fully two million trees will probably be planted out.

Statement of Expenditure.

	£	s.	d.
Amount at the 31st March, 1909	18,150	0	6
Pitting	812	11	11
Tree-planting	563	17	2
Clearing	1,314	18	10
Cartage of trees	28	4	0
General upkeep of plantation	731	8	1
„ repairs	4	7	9
Horse-feed purchased and grown	93	4	10
Fencing	36	9	6
Buildings—			
Cottage for foreman	65	16	8
New prison camp	540	15	6
Tools, implements, &c.	58	16	8
Miscellaneous works	12	2	0
Formation	74	8	6
Salaries—			
Supervision of prison labour	145	0	0
„ free labour	160	0	0
Nurseryman's proportion of	35	0	0
Proportion of clerk and accountant's salary	44	0	0
	£22,871	1	11

D. J. Buchanan, Plantation Foreman.

Ruatangata Nursery (near Whangarei).

(Area, 65 acres; altitude, 320 ft.)

Rain fell on 181 days during the year, with a total fall of 65·54 in., the maximum monthly fall being in August, when 10·77 in. fell on twenty days. The highest shade temperature registered was 83°, on the 16th and 30th December and 26th January, and the lowest 30°, on the 10th August. There were seven frosts recorded, the maximum being 2° on the 10th August.

Taking the year right through, the weather has been favourable for all kinds of work at this station, with the exception of harvesting the crop. This was unfortunate in getting several days rain on it immediately after being cut. The only noteworthy incidents with regard to the weather for the past year are that on the 30th March the barometer fell from 29·54 to 28·38 in less than thirty hours, which is a record for the last seven years; and the number of days on which rain was recorded coincides exactly with that of the previous year, the rainfall being about 6 in. more.

Owing to the failures amongst *Podocarpus Totara* in the plantation it was decided to discontinue growing this tree; consequently there was no lining-out done in the nursery during the season. 70,000 eucalypti were lined-in during the winter months, at a cost of 2s. 1½d. per thousand. By lining the eucalypti in closely, and keeping them in check by constant root-cutting with the spade until they have made good fibrous roots, the costly method of mossing each tree separately is done away with, and the results in the plantation of trees planted unmossed are equally as good as those that were mossed, therefore there will be no trees mossed during the coming season. 199,000 eucalypti were mossed, at a cost of 13s. 3¾d. per thousand. These comprised the following species: *E. resinifera*, *E. rostrata*, *E. Stuartiana*, and *E. amygdalina*. The sowing of eucalypti seed was commenced on the 5th November, and continued at intervals, when the weather was favourable, until the 15th December; 9 lb. of *E. Stuartiana* seed was sown, resulting in a splendid crop of 350,000 seedlings, valued at £175.

Trees to the number of 325,325 were sent out to the plantation during the season, valued at £412 18s. 3d. (particulars in Schedule 1 attached).

The approximate number of trees available for transferring to Puhipuhi Plantation during the coming season is 350,000. The total number of trees transferred to Puhipuhi Plantation since the inception of this nursery is 1,813,570, valued at £4,432 9s. 1d.

One of the houses erected for the accommodation of the men was papered and painted, &c., and is now used as a nurseryman's cottage.

When the Department decided to discontinue planting *Podocarpus Totara* in the plantation at Puhipuhi there were over 100,000 trees in stock, and it was recommended and approved that these be distributed free amongst settlers who were willing to plant them, the applicants to pay the cost of carriage to destination. 50,262 trees were distributed in this way, being sent into

nearly every province in the North and South Islands. There is a balance of 50,000 trees still on hand, and these are to be distributed on the same terms as those sent out last year, and there should be no difficulty in getting rid of them, as settlers are inquiring already this season, which would indicate that the trees sent out last year were a success.

Instructions have been issued to cease operations here at the end of September of the present year, the reason being that the trees are not succeeding in the plantation at Puhipuhi. As it is probable that the nursery grounds will be leased, all the land at present under cultivation will be laid down in permanent grass. The ground is now being prepared for this, and by the end of April it is hoped to have 22 acres sown.

Horse-feed to the value of £120 was grown.

Average number of workmen employed, 5·77.

Details of expenditure and values are appended.

The total number of trees raised at this nursery since May, 1903, is 2,667,868, valued at £5,188 13s. 9d.

The following is a record of the rainfall and temperature for the year:—

Month.	Rainfall.	Number of Days with Rain.	Maximum Temperature.	Date.	Minimum Temperature.	Date.
1909.	Inches.		Degrees.		Degrees.	
April	2·26	6	72	4th	33	25th
May	5·75	14	66	6th and 23rd	32	15th
June	3·37	20	65	12th and 13th	31	30th
July	8·25	23	63	19th	33	7th, 12th, and 25th
August	10·77	20	61	25th	30	10th
September	7·09	21	65	26th	31	10th
October	5·57	10	72	31st	38	24th
November	4·36	8	75	17th	42	7th
December	1·96	9	83	16th and 30th	45	31st
1910.						
January	4·26	16	83	26th	49	2nd
February	6·15	14	78	14th	48	3rd
March	5·75	20	78	11th	46	19th, 20th, and 26th
Totals	65·54	181	...	...	...	...

SCHEDULE 1.—One-year-old Trees, grown at Ruatangata Nursery, 1909–10. (Seventh Crop.)

Name.	Number in Seed-beds.	Height in Inches.	Seed sown.	Value per Thousand.	Total Value.	Remarks.
			Lb.	£ s. d.	£ s. d.	
Eucalyptus Stuartiana ..	350,000	4	9	0 10 0	175 0 0	Fine sturdy plants and very even crop.

SCHEDULE 2.—Trees transferred from Ruatangata Nursery to Puhipuhi Plantation, &c., 1909. (Sixth Crop.)

Name.	Number.	Value per Thousand.	Total Value.	Remarks.
		£ s. d.	£ s. d.	
Mossed—				
Eucalyptus resinifera	32,750	1 10 0	49 2 6	Doing very well.
" Stuartiana	29,500	1 10 0	44 5 0	Doing exceedingly well.
" rostrata	106,200	1 10 0	159 6 0	Very poor growth.
" amygdalina	12,600	1 10 0	18 18 0	"
Unmossed—				
Eucalyptus resinifera	17,500	1 10 0	8 15 0	Doing very well.
" Stuartiana	22,875	1 10 0	11 8 9	Equal to mossed.
" rostrata	90,200	1 10 0	45 2 0	Doing very poorly.
Sequoia sempervirens	11,650	6 0 0	69 18 0	Making fair growth.
Juniperus virginiana	2,050	3 0 0	6 3 0	"
	325,325	..	412 18 3	
Podocarpus Totara	50,262	4 5 0	213 12 3	Distributed to farmers.
	375,587			
10 tons oaten chaff valued at £5 per ton	..	..	50 0 0	Sent to Rotorua.
			676 10 6	

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	7,444	7	3
Tree-growing	437	2	11
General maintenance and repairs	65	3	7
Nursery-formation	9	11	6
Horse-feed purchased and grown	121	7	2
Manures	9	5	0
Tree-seeds	9	12	0
Tools, implements, &c.	0	3	8
Water-supply	0	15	6
Miscellaneous works	0	7	5
Proportion of Nurseryman's salary	150	0	0
Supervision	25	0	0
Proportion of clerk and accountant's salary	44	0	0
	£8,316	16	10

Value of Stock, Improvements, &c.

	£	s.	d.	£	s.	d.	£	s.	d.
Amount at 31st March, 1909				5,292	4	11			
Less value of trees	1,601	7	6						
" horse-feed	150	0	0						
" tools written off during year	24	1	9						
				1,775	9	3			
							3,516	15	8
Trees, as per Schedule 2							175	0	0
Tools and implements							0	3	8
Water-supply							0	15	6
Nursery-formation							9	11	6
Horse-feed in stock							140	0	0
Value of young horses bred or increased value during year							5	0	0
							£3,847	6	4

Summary.

	£	s.	d.
Value of present stock and general improvements	3,847	6	4
Value of trees sent out since initiation of nursery	4,696	1	4
	8,543	7	8
Expenditure to date	8,316	16	10
Credit balance	£226	10	10

A. GORDON, Nurseryman in Charge.

PUHIPUHI PLANTATION.

(Area, 2,100 acres; altitude, 1,000 ft.)

The rainfall exceeds that of the previous year by 18 in., rain being recorded on 196 days, with a total fall of 89·02 in. During twenty-one days in July 13·67 in. fell. Several times during this month the Wairiki Stream was in flood, making it impossible to take the horse over the ford, the trees having to be carried from the timber dam to the planters, a distance of over a quarter of a mile, adding considerably to the cost of planting.

There were 125,325 eucalypti planted out permanently at 6 ft. apart, occupying 104 acres, costing 13s. 3d. per thousand, as against 11s. 5d. for the previous year. The extra cost of planting can be accounted for by the fact that nearly all the trees that were received from the nursery this year were lined-in closely in nursery rows, the cost being added to the item "Planting." The lining-in was done to avoid carting when the roads were bad during the months of July and August. The remaining 200,000 trees were used to replace blanks in eucalypti and totara failures over an area of 450 acres. 251,950 spade and grubber pits were made, at an average cost of 19s. 5d. per thousand.

All standing dead timber and manuka within the fenced area, about 300 acres, was felled by day-labour, at a cost of 2s. 2d. per acre. 350 acres of fern, &c., was burned off, costing 2s. 11½d. per acre. The bulk of the land cleared is fairly good, with about 40 acres heavy gum land and 40 acres gravelly. Fern was cut and burned 1 chain wide on 960 chains of boundary fire-breaks, and of this, 235 chains was ploughed and harrowed.

The main road from Whakapara to the plantation is in a very neglected state, and £5 16s. 6d. was expended in removing land-slips and clearing water-tables in order to make the road passable. Portions of the boundary-fence, close to the Wheneroa Creek, were constantly being carried away

by flood-waters, requiring considerable expense in keeping out cattle. This was replaced by 25 chains of five-wired fencing on higher land. A substantial four-roomed cottage with lean-to and outbuildings was purchased, and erected on a site overlooking the greater portion of the plantation.

This is the first season eucalypti have been planted extensively without moss in this plantation. Where the trees were from 12 in. to 18 in. high at the time of planting the death-rate is not more than 2 per cent.; the smaller trees are a failure, especially so in the case of *E. rostrata*. *E. Stuartiana* have made vigorous growth, one tree reaching a height of 4 ft. 4 in. in one year, the average growth being about 18 in. The difference in mossed and unmossed trees is not marked, though the latter are slightly sturdier. *E. resinifera* have made good healthy growth. *E. amygdalina* and *rostrata* are not so good, the approximate death-rate being fully 25 per cent., principally amongst the smaller trees. Several of the *E. Stuartiana* planted three years ago are now from 15 ft. to 18 ft. 2 in. in height, with girths from 9 in. to 11 in. This species is perfectly clean and healthy, and entirely free from the ravages of insect life.

Clearing round trees, planting blanks, and upkeep of fire-breaks, &c., cost £790 1s. 6d.

The Department having decided to discontinue raising trees at Ruatangata Nursery after this season, it would be advisable to sow a small quantity of *E. Stuartiana* seed on the plantation, the trees to be utilised for replacing blanks, as this season's planting will not nearly cover the whole of the plantation; fully half a million more trees will be required.

The average number of men employed was 11·03.

The following is a record of rainfall and temperature for the year:—

Month.	Rainfall.	Number of Days Rain fell.	Maximum Temperature.	Date.	Minimum Temperature.	Date.
1909.	Inches.		Degrees.		Degrees.	
April	2·44	11	76	5th, 6th, and 24th	34	26th
May	7·79	18	70	5th and 6th	36	17th
June	3·76	19	64	5th and 20th	38	9th and 20th
July	13·67	21	66	10th	34	1st and 25th
August	11·44	20	62	4th, 24th, and 25th	30	10th and 19th
September	12·67	22	66	16th and 27th	32	10th
October	4·59	16	66	3rd, 12th, and 31st	38	10th and 14th
November	5·95	13	78	11th and 19th	42	7th
December	1·78	11	82	18th	46	15th
1910.						
January	4·86	13	82	25th and 27th	50	2nd
February	12·34	14	78	16th	55	3rd
March	7·73	18	74	12th	52	18th, 23rd, and 25th
Totals ...	89·02	196	...	...	...	...

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	6,486	11	8
Pitting	244	8	6
Tree-planting	116	2	5
Clearing	72	17	6
Cartage of trees	21	18	1
General upkeep of plantation	804	15	10
„ repairs	22	18	5
Horse-feed purchased and grown	1	15	11
Buildings	90	11	4
Tools, implements, &c.	0	18	9
Salaries—			
Foresters: Supervision of free labour	170	0	0
Nurseryman's proportion of	20	0	0
Proportion of clerk and accountant's salary	44	0	0
Supervision	25	0	0
	£8,121	18	5

J. MASON, Plantation Foreman.
A. GORDON, Nurseryman in Charge.

APPENDIX C.

REPORT ON TREE-GROWING OPERATIONS IN THE SOUTH ISLAND.

(By the Superintending Nurseryman, Tapanui.)

A perusal of the various detailed reports attached will show that the afforestation work has advanced creditably, and, notwithstanding the extreme dryness experienced at the Otago stations, highly satisfactory results are disclosed.

During the year 6,300,875 seedlings have been raised at the three nurseries, representing a value of £6,292 10s. 3d., and on the four plantations 2,427,124 trees were permanently planted, occupying an area of 891½ acres. The total area now planted amounts to 4,831¼ acres, containing 12,050,003 trees.

The nurseries contain 13,121,830 trees, of ages ranging from one to four years, and their output to the various plantations during the past year amounted to 2,814,658 trees, which are valued at £8,361 3s. 7d. The total output of trees from the southern nurseries since initiation is 21,286,734, and these are valued at £53,479 1s. 8d., as per Table C.

The expenditure incurred on nurseries and plantations during the year was £8,777 12s. 4d., and the total amount expended since September, 1896, is £100,431 1s. 2d.

An average number of 58·31 men were employed by day and contract labour. At Hanmer Springs 13·53 prisoners were also engaged at pitting and tree-planting, and the average value of work done per man for the year is £60 10s. 6d.

This amount is slightly below the estimated value of the previous year's work, but as the greater portion of the area operated upon was a considerable distance from the camp, more time was occupied in walking to and from work than heretofore.

It is satisfactory to record that good faithful work has been performed by the prisoners generally, although the small number in camp was quite inadequate to undertake the whole of the tree-planting.

The excellent rainfall at Hanmer Springs—totalling 43·74 in.—was the chief factor in bringing about unprecedented results at both nursery and plantation, and instances where larches have increased their height by nearly 5 ft. during the season are numerous. Over the greater part of Otago, however, the want of moisture during the midsummer period was keenly felt, and plantations generally do not possess their customary healthy appearance.

At Dusky Plantation evidence of the partial drought was clearly demonstrated by the blocks of *Larix europæa* assuming autumnal tints fully six weeks before the usual period, and also by the rapid decay of lateral branches that clothe the outside lines of trees to the ground-surface.

Owing to the shortage of labour at Conical Hills Plantation towards the latter part of the season, it was necessary to introduce a combined system of scuffling spots and planting in the one operation. By this method 774,300 trees were dealt with at 11s. 7d. per thousand, and, although we have every reason to be satisfied with results, planting by the grubber-pitting system is preferable, and will be adopted where practicable during the ensuing year.

Trees established at Naseby Plantation, although not growing with the same rapidity as at the more favoured stations, are thriving.

The circumstances connected with the acquirement of the extension area of about 125 acres on Naseby Commonage are somewhat unfortunate, and at the present moment no decision has been arrived at regarding the continuance of tree-planting work in Central Otago.

General Maintenance of Plantations.

It may be readily understood that the growth of tussocks and fern around trees on the greater portion of the land set apart for afforestation is usually so vigorous that the employment of a gang of men is necessary to suppress same. The expenditure on this item, however, ceases immediately the "leaders" of trees are beyond the influence of undergrowth, which is usually two years from time of planting. *Picea excelsa* are proving to be extremely slow growers even in the most favourable situations, and make poor headway for at least four years, after which their rate of progress compares satisfactorily with other varieties dealt with. Pruning, so far, has been confined to the correcting of irregularities of growth caused by unseasonable frosts and gales. The larches require the most attention, whilst pines are the least susceptible to injury.

The keeping of fire-breaks in an effective state continues to absorb the bulk of horsework during the summer months, and the question of converting these breaks into grazing-areas in the near future, and allowing sheep to feed thereon, may be favourably considered.

System of Planting and Thinning.

As many of the trees at Dusky Plantation are now twelve years old, and have reached a height of from 20 ft. to 30 ft., a few words on the above subject will not be out of place.

Our "mixed woods" system of planting has not been altogether successful, and it is fortunate that no large area has been allocated to this method. Trees planted to form the ultimate crop have been quite suppressed by the nurses, whilst in other blocks may be seen specimens of the strong-growing Oregon pine towering high above the pines and larch. In either of these instances success cannot be anticipated. Of recent years, however, our efforts have been directed towards

the extension of the "pure woods" system, and results fully justify the continuance of this popular continental mode of planting. Where larch have been planted "pure," evidence is abundant of the cessation of the struggle for existence by the smaller trees, which are unable to exist under the canopy formed by the dominating specimens.

Thinning operations, to any extent, even in our most advanced southern plantation, will not require to be introduced for at least five or six years, but from that period onward the work of under-planting with shade-enduring varieties may be conducted.

Enemies of our Plantations.

In the animal world rodents, such as rabbits and hares, are proving to be the most persistent and inveterate that our plantations have to contend with. All recognised schemes for their eradication are brought into effect, but it is an intensely difficult problem to keep newly acquired reserves quite free from rabbits, particularly when dry seasons render the boundary river ineffective as a barrier to the animals.

Several specimens of diseased *Picea sitchensis* were received from the Canterbury Province, and show unmistakable signs of damage being caused by the red mite (*Byrobia pratensis*), which is often most destructive to members of the spruce family. No notification of the presence of this insect in any of the State plantations has, however, reached me.

The grubs (*Odontria* Z.) have again been conspicuous for a short period in the nurseries, but the method now adopted of ridding the ground of this destructive bark-eating larvæ, by intense cultivation, is proving effective, and future losses amongst our lined-out trees should be considerably reduced.

Prevention of Fires.

Additional measures for the prevention of fire were brought into practice during the year, and it is gratifying to be able to report the entire absence of any conflagration at the southern stations. On each Sunday and holiday during the summer months an employee was selected to patrol the plantation, and be ready to act immediately in case of any outbreak of fire. New fire and trespass notices were mounted on boards and erected in conspicuous places at each of the plantations, and extension "breaks" were marked off and ploughed where desirable.

Library on Forestry Literature.

Arrangements are being made to formulate a library of advanced literature on forestry, for the use of officers connected with the Department. Success in creating forests can only, in my opinion, be achieved by unanimity of object amongst those in charge of stations, who at the present moment differ somewhat in their opinions regarding the labour essential to bring about desired results. No particular scheme of imparting general instruction has yet been decided upon beyond the decision to issue books to the various officers, who, on perusal of any selected subject, will freely comment on principles advocated by the author, and forward the composition for remarks. Needless to state that interchange of ideas will prove of immense benefit to all concerned, and should facilitate the supervision of the various stations.

Proposals for 1910–11.

Conical Hills Plantation.—Preparations are now well in hand for the planting of an approximate 1,600,000 trees at this station. These will be supplied by the Tapanui Nursery, and there is a probability of the number being supplemented by nearly 400,000 from Central Otago.

The erection of 120 chains of wire-netting fence is contemplated; this block-planting system is indispensable where rabbits have to be contended with, although no further expenditure in this direction will be required to complete the planting of the whole area available. Pruning and general maintenance on No. 1 area will be undertaken by a gang of three men.

Dusky Hill Plantation.—The three unused huts are now being drawn together, and will be converted into a dwellinghouse for the foreman, whose constant presence on the reserve will render the employment of caretakers unnecessary. Only two men will be retained here, and their time will be fully occupied in pruning and general work.

Gimmerburn Plantation.—A horseman will be kept at this station, whose duties, besides attending to plantation requirements, will include the growing of horse-feed for transference to other South Island nurseries.

Hanmer Springs Plantation.—1,390,000 trees are sufficiently advanced at the local nursery for permanent planting, and every effort will be made to deal successfully with these by both prison and free labour. An adjoining area of some 1,080 acres has been acquired for extension purposes, and, as the bulk of the planting will be confined to this block, fencing operations will be commenced immediately. General maintenance, in the form of pruning, &c., will also be carried on here where necessary.

Personal.

Able assistance has been rendered willingly by the staff, who have carried out their duties conscientiously, and the thanks of the Department are also due to the warder in charge and officers of the Prisons Department at Hanmer Springs.

Mr. T. B. Curle, Nurseryman in Charge, and Mr. R. Leask, Assistant Forester, both of Hanmer Springs, resigned during the year, and were succeeded by Mr. W. G. Morrison, of Conical Hills Plantation, and Mr. A. J. Boydell, of Hanmer Springs Nursery.

R. G. Robinson,
Superintending Nurseryman, South Island.

Ten-year-old Larch, Whakarewarewa.

HANMER NURSERY

Pinus austriaca, HANMER

Tapanui Nursery.

(Area, 120 acres; altitude, 500 ft.)

Rain fell on 141 days, with a total precipitation of 31·67 in., the maximum monthly fall being 4·40 in., in October. The highest shade temperature recorded was 95°, on the 23rd December, and the lowest 21°, on the 1st June.

Although successful results have been achieved in tree-raising, the season has been one of the most distinctly trying yet experienced. A mild winter, permitting good headway to be made with tree-lifting, was succeeded by a perfect spring, and whilst lining-out was in progress copious rains fell at desired intervals. The summer, however, proved to be one of the driest yet recorded in the district, and only by intense cultivation have the trees been able to withstand the drought. Creeks in the locality that have hitherto been fed constantly by springs completely dried up, and well-sinking was generally resorted to by those who were thus affected.

Seed-sowing was conducted under favourable conditions during the second week in October, and, although the expenditure attached to the purchase of seeds this year was £20 below that of the previous season, 140,000 more plants have been realised.

An excellent crop of 1,800,000 *Pinus Laricio* resulted from 150 lb. of seed, but the plants are scarcely up to the average standard. *Larix europæa* germinated thinly, although the seedlings have developed into fine sturdy plants, all of which will require to be transplanted into lines during the coming season. *Pinus ponderosa* and *Pinus muricata* are both satisfactory crops, and the remainder of varieties, as detailed on Schedule 1, are also about the average. A trial sowing was made of *Tsuga canadensis*, *Liquidambar styraciflua*, *Thuja canadensis*, *Taxodium distichum*, *Gymnocladus dioicus*, and *Tilia americana*, but only the two first named varieties have succeeded.

During a favourable season fair results might be anticipated in dealing with these seeds, but past experience tends to show the folly in attempting to raise any but the hardier trees in the district.

It may be interesting to mention that, notwithstanding the lack of rain, no artificial watering of seed-beds was attempted, but a departure from our usual custom was made in allowing the scrim to remain on frames throughout the whole summer, and only removing the covering in time to allow the tender plants to "harden off" before the advent of the cold weather.

There were 1,466,250 seedlings transferred to nursery lines, at 1s. 9d. per thousand. The grass grubs were quickly in evidence, and severe losses were anticipated through their ravages. The combined agencies of constant tillage and dry weather, however, speedily reduced their number, and only a trifling amount of damage eventuated.

An approximate 1,600,000 trees have developed into a desirable size for transference to plantations during the approaching winter. This estimated output, however, may be somewhat modified to meet plantation requirements, as it is doubtful if sufficient number of pits will be in readiness for their reception.

Tree-growth generally is about the average, although since the late rains several "breaks" of larch have made unprecedented headway, necessitating the wrenching of same, to check any further progress.

Buildings, Improvements.—It is satisfactory to record that all improvements effected were carried out by employees. A convenient office of small dimensions was erected some distance from the workshop, and much advantage is derived by being able to conduct the clerical work in quietness.

Additions were made to the iron sizing-shed, which in its enlarged state permits of our winter work being undertaken with greater facility. The benches attached to the walls of the shed were also replaced by a long table that occupies the centre of the room, and more space is now available for the storage of trees.

A concrete culvert on the main roadway was substituted in place of the fast-decaying wooden structure, and substantial flood-gates on Whisky Creek are now in course of construction.

The combined shelter and ornamental plantations have made such rapid progress as to prohibit any further attempt at cultivating between the trees. The area was accordingly sown down in grass, and further maintenance work in connection with same will be a small item.

There were 5,500 *Larix europæa* used in planting a triangular block of ground within the nursery enclosure. The close-planting method was adopted, and the conversion of another small area not used for grazing purposes into an ash compartment, to be worked under the coppice system, will be undertaken during the forthcoming year.

An area of about 20 acres was sown down in permanent grasses, and should provide the much-needed early spring pasture for our stock.

Two more well-bred foals were added to our live-stock register, and it is now possible to transfer two of the older animals to the plantations, where the presence of serviceable horses is greatly needed for packing and sundry work.

Fencing.—Forty-five chains of fencing was erected, thus completing the required subdivision of paddocks.

The sum of £10 17s. 3d. was expended in improving the water-service, but further efficiency is being aimed at by a proposal to extend the pipes some 50 yards from the present source to a spring on the hillside.

The oat, rye, clover, and carrot crops were successfully harvested, and abundant horse-feed is in stock to meet the forthcoming local requirements for the year.

The annual expenditure amounted to £1,801 5s. 2d., giving employment to 10·3 men.

All shoeing and repairs connected with local stations were carefully executed by our blacksmith during unfavourable weather for outdoor work. Several of the employees are fortunately proficient also in carpentry, saddlery, &c., and needless to say a great saving of time is realised by being able able to place all general repairs in their hands.

As per Schedule 4, 1,574,228 trees, valued at £4,704 2s. 10d., were transferred to the various plantations and domains, and preparations are now being made for the removal of a slightly increased number this winter.

Statement of expenditure and values are appended.

The following is a record of rainfall and temperature for the year :—

Month.	Rainfall.	Number of Days Rain fell.	Maximum Temperature.	Date.	Minimum Temperature.	Date.
1909.	Inches.		Degrees.		Degrees.	
April	3·24	10	65	18th	28	24th
May	1·12	10	67	19th	29	17th
June	3·78	14	62	3rd	21	1st
July	0·82	11	57	21st	23	3rd
August	3.75	16	67	31st	27	12th
September	1·81	13	69	15th & 25th	27	3rd
October	4·40	17	74	31st	32	16th
November	4·17	10	78	24th	33	20th
December	1·50	10	95	23rd	41	12th
1910.						
January	2·81	12	86	24th	47	6th
February	1·97	7	85	7th	45	3rd
March...	2·30	11	86	9th & 10th	35	22nd
Totals	31·67	141	...	...	...	...

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	17,270	4	11
Tree-growing	944	8	7
General maintenance	157	0	5
Nursery-formation	19	5	4
Horse-feed purchased and grown	75	17	4
Manures	10	0	4
Tree-seeds	95	0	5
Tools, implements, &c.	7	14	6
Water-supply	10	17	3
Buildings—office, additions to shed and stable	147	1	7
Fencing	49	19	0
Miscellaneous works	51	8	2
Proportion of Nurseryman's salary, clerical assistance, and travelling-expenses	210	2	3
Supervision	22	10	0
	£19,071	10	1

Value of Stock, Improvements, &c.

	£	s.	d.	£	s.	d.	£	s.	d.
Amount at 31st March, 1909 ...				16,285	0	5			
Less value of trees at 31st March, 1909	8,369	7	0						
Less horse-feed in stock at 31st March, 1909	103	9	7						
				8,472	16	7			
							7,812	3	10
Trees, as per Schedule 1							2,659	9	3
" " 2							2,729	8	0
" " 3							2,767	6	6
Tools and implements							7	14	6
Water-supply							10	17	3
Nursery-formation							19	5	4
Fencing							49	19	0
Buildings							147	1	7
Improved value							232	12	3
Horse-feed in stock							78	16	8
Value of young horses bred, or increased value, during year ...							35	0	0
							£16,549	14	2

Summary.

	£	s.	d.
Value of present stock and general improvements	16,549	14	2
Value of trees sent out since initiation of nursery	30,972	4	2
	47,521	18	4
Expenditure to date	19,071	10	1
Credit balance	£28,450	8	3

Stock in Hand.

SCHEDULE 1.—Details of One-year-old Trees, grown 1909–10. (Thirteenth Crop.)

Name of Tree.	Number in Seed-beds.	Height in Inches.	Seed sown.	Value per Thousand.	Total Value.	Remarks.
			Lb.	£ s. d.	£ s. d.	
Larix europæa	520,000	3	222	1 0 0	520 0 0	Well-grown plants.
„ occidentalis	100	1½	⅛	1 5 0	0 2 6	Experimental.
Pinus Laricio	1,800,000	2½	150	1 0 0	1,800 0 0	Excellent crop.
„ ponderosa	250,000	2½	30	1 0 0	250 0 0	Sturdy plants.
„ muricata	11,000	5	3	1 0 0	11 0 0	„
Fraxinus excelsior	15,500	3	60	1 0 0	15 10 0	Fair crop.
„ americana	1,750	4	20	1 0 0	1 15 0	„
Betula alba	18,000	1½	10	1 0 0	18 0 0	„
Alnus glutinosa	44,000	1½	7	0 15 0	33 0 0	„
Pyrus aucuparia	225	4	¼	1 10 0	0 6 9	„
Tsuga canadensis	10,000	1	½	1 5 0	12 10 0	Germinated well.
Liquidambar styraciflua ..	1,500	2½	1	1 10 0	2 5 0	„
Totals..	2,667,075	..	..	..	2,659 9 3	

SCHEDULE 2.—Two-year-old Trees, grown 1908–9. (Twelfth Crop.)

Name of Tree.	Number in Seed-beds.	Number in Nursery Lines.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
				£ s. d.	£ s. d.	
Larix europæa	667,500	222,500	12	1 5 0 / 2 0 0	1,279 7 6	Well-grown trees.
Pinus Laricio	534,000	..	6	1 5 0	667 10 0	„
„ ponderosa	356,000	21,000	5	1 5 0 / 2 5 0	492 5 0	„
Pseudo-tsuga taxifolia	..	10,500	5	2 10 0	26 5 0	Fair growth.
Picea sitchensis	29,000	..	4	2 10 0	72 10 0	„
Fraxinus excelsior	40,000	..	7	1 5 0	50 0 0	Strong trees.
Betula alba	1,500	..	10	2 5 0	3 7 6	„
Alnus glutinosa	..	2,700	9	2 0 0	5 8 0	„
Quercus pedunculata	..	19,000	7	2 5 0	42 15 0	„
Thuja gigantea	30,000	..	3	3 0 0	90 0 0	„
Totals	1,658,000	275,700	..	..	2,729 8 0	
	1,933,700					

SCHEDULE 3.—Three-year-old Trees, grown 1907–8. (Eleventh Crop.)

Name of Tree.	Number in Nursery Lines.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
			£ s. d.	£ s. d.	
Larix europæa	107,750	15	3 0 0	323 5 0	These trees, without exception, have made excellent growth.
Pinus austriaca	2,800	6	3 0 0	8 8 0	
„ Laricio	594,000	6	3 0 0	1,782 0 0	
„ ponderosa	41,000	7	3 0 0	123 0 0	
„ Benthamiana	10,300	7	3 5 0	33 9 6	
„ muricata	1,300	9	3 0 0	3 18 0	
Picea excelsa	102,500	9	3 0 0	307 10 0	
„ sitchensis	15,600	8	3 5 0	50 14 0	Ditto.
Pseudo-tsuga taxifolia	11,000	7	3 5 0	35 15 0	
Fraxinus excelsior	700	10	3 0 0	2 2 0	
Fagus sylvatica	4,600	15	3 5 0	14 19 0	„
Sequoia sempervirens	475	20	6 0 0	2 17 0	
Alnus glutinosa	6,800	15	2 5 0	15 6 0	
Acer pseudo-platanus	1,600	16	1 10 0	2 8 0	
Betula alba	23,000	12	2 5 0	51 15 0	„
Thuja gigantea	100	10	4 0 0	0 8 0	
Various trees, &c.	3,200	12	3 0 0	9 12 0	
Totals	926,725	..	..	2,767 6 6	

SCHEDULE 4.—Trees transferred from Tapanui Nursery to Plantations, &c., 1909–10.

Where sent.	Name of Tree.	Number.	Height in Inches	Value per Thousand.	Total Value.	Remarks.
				£ s. d.	£ s. d.	
Conical Hills Plantation	Pinus Laricio	203,575	12	3 0 0	610 14 6	A very satisfactory "strike" was obtained in all trees planted.
	" austriaca	34,875	12	3 0 0	104 12 6	
	" ponderosa	20,925	12	3 0 0	62 15 6	
	" Benthamiana ..	12,525	14	3 5 0	40 14 2	
	Larix europæa	858,350	15	3 0 0	2,575 1 0	
	Picea excelsa	120,650	15	3 0 0	361 19 0	
	" sitchensis	45,000	15	3 0 0	135 0 0	
	Pseudo-tsuga taxifolia ..	5,225	15	3 5 0	16 19 8	
	Betula alba	9,350	15	2 0 0	18 14 0	
	Fraxinus excelsior ..	4,925	15	3 0 0	14 15 6	
	" americana ..	925	14	3 0 0	2 15 6	
	Acer pseudo-platanus ..	33,700	16	2 15 0	92 13 6	
	Quercus pedunculata ..	54,175	15	3 0 0	162 10 6	
	Alnus glutinosa	13,500	15	3 0 0	40 10 0	
	Totals	1,417,700	..	..	4,239 15 4	
Dusky Hill Plantation	Pinus Laricio	118,000	12	3 0 0	354 0 0	These trees were used in completing the replanting of area destroyed by fire.
	Larix europæa	1,500	15	3 0 0	4 10 0	
	Picea excelsa	2,500	14	3 0 0	7 10 0	
	" sitchensis	6,750	14	3 0 0	20 5 0	
	Pseudo-tsuga taxifolia ..	800	14	3 5 0	2 12 0	
	Betula alba	1,500	15	2 0 0	3 0 0	
	Fraxinus excelsior ..	500	15	3 0 0	1 10 0	
	Quercus pedunculata ..	3,250	15	3 0 0	9 15 0	
	Totals	134,800	..	..	403 2 0	
Waitahuna Plantation	Pinus Laricio	2,000	12	3 0 0	6 0 0	Excellent progress has been made by all varieties.
	" ponderosa	500	12	3 0 0	1 10 0	
	Larix europæa	7,000	15	3 0 0	21 0 0	
	Betula alba	1,500	15	2 0 0	3 0 0	
	Alnus glutinosa	500	15	3 0 0	1 10 0	
	Totals	11,500	..	..	33 0 0	
Conical Hills Plantation	As per details above ..	1,417,700	..	..	4,239 15 4	
Dusky Hill Plantation	" ..	134,800	..	..	403 2 0	
Waitahuna Plantation	" ..	11,500	..	..	33 0 0	
Hanmer Springs Plantation	Alnus glutinosa	2,500	..	..	5 0 0	
Naseby Plantation ..	Assorted forest trees ..	2,500	..	..	5 10 0	
Borough Council, Port Chalmers	" ..	2,500	..	..	7 10 0	
Borough Council, Green Island	" ..	140	..	..	0 12 6	
Acclimatisation Society, Clinton	" ..	100	..	..	0 10 0	
Domain Board, Waiau	" ..	400	..	..	1 12 0	
Domain Board, Tapanui	" ..	200	..	..	0 16 0	
School Reserve, Moa Flat	" ..	300	..	..	1 4 0	
School Reserve, Kokonga	" ..	175	..	..	0 15 0	
Industrial Schools, Burnham	" ..	150	..	..	0 12 0	
Hospital Committee, Gore	" ..	213	..	..	1 2 6	
Barewood Settlement	" ..	1,050	..	..	3 1 6	
	Totals	1,574,228	..	..	4,704 2 10	

R. G. ROBINSON,
Superintending Nurseryman.

DUSKY HILL PLANTATION, OTAGO.

(Area, 845 acres; altitude, 400 ft. to 800 ft.)

It is impossible to render a favourable report on the past season's progress of trees at this station, but this is fully accounted for by the intensely dry weather experienced in the district. Throughout the whole summer the ground surface presented no sign of moisture, and it is not to be wondered at that trees materially suffered. Only few deaths are recorded, although an unhealthy yellow appearance prevails amongst the larch compartments. The "leaders" appear to have absorbed the sap available, to the detriment of other parts of the tree. No permanent ill effects, however, should eventuate if a fair rainfall is received during the coming winter. It is interesting to note that *Larix leptolepis* (Japanese larch) does not appear so sensitive to drought

as the European species, for whilst the former variety furnishes little indication of having passed through an unusually dry period, *Larix europæa* growing in the immediate vicinity under precisely the same conditions have undoubtedly suffered.

There were 106,158 trees put out, at 11s. 4½d. per thousand, and the whole of the burnt-out area has now been replanted. 28,642 trees were also planted in places where success was not attained previously.

An average of 3·7 men were engaged here, and their time was chiefly allocated to tree-pruning, attending to fire-breaks, forming tracks, and general maintenance. The immediate future maintenance work should necessitate the employment of only two or three men, and arrangements have already been made to reduce the staff accordingly.

It was decided to draw together with a team of bullocks the three huts remaining unoccupied, and form a dwellinghouse for the foreman. This work has already been taken in hand by the nursery carpenters, and is now well advanced.

As in the previous year, the Pomahaka River fell to a very low level several times, and failed to form a barrier to a number of cattle and sheep. No damage was created by their presence, although a loss of time was necessitated in ejecting the animals from the reserve.

Several fire notices were posted up along the fringe of plantation, and at other conspicious places, as a greater precaution against careless use of fire. Caretaking has also been resorted to during the summer months. Living accommodation for the foreman now having been provided, his constant presence will enable extra caretaking duties to be dispensed with.

A statement of expenditure for the year is appended:—

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	11,499	15	2
Tree-planting	73	10	0
Cartage of trees	4	4	6
General upkeep of plantation	366	13	10
Horse-feed, purchased and grown	15	2	11
General repairs	8	2	0
Miscellaneous works	8	6	10
Proportion of nurseryman's salary	15	0	0
Supervision	10	15	0
	£12,001	10	3

F. Benfell, Plantation Foreman.
R. G. Robinson, Superintending Nurseryman.

Conical Hills Plantation, Otago.

(Area, 3,672 acres; altitude, 400 ft. to 1,050 ft.)

The locality in which this station is situated has not been immune from partial drought during the past summer, and consequently trees growing in the drier situations have not made such vigorous headway as in former years. All pines established, however, are making consistent progress, whilst larch, Oregon pine, and spruce fir that occupy the more sheltered positions are succeeding beyond expectations.

Towards the end of May tree-planting operations were commenced, and continued until October, and during that period 1,347,700 trees were permanently put out. Planting in grubber pits cost 12s. 4d. per thousand, whilst the preparation of scuffled spots and "dibbling" trees amounted to only 11s. 7d. per thousand for the double operation.

The "dibbling" system cannot be generally adopted, as it would be courting distinct failure to deal with ground of a clayey nature in this manner. Arrangements are being made this year to prepare as many pits as possible on the harder ground for the reception of trees, and reserve the areas containing the lighter and more porous surface soil for the "dibbling" process.

Of the 858,350 *Larix europæa* planted this season very few failed to strike. *Pinus Laricio* were also a success, although in one block where smaller trees were experimented with rather more than 5 per cent. of deaths occurred.

There were 619,921 pits prepared by day-labour, at 14s. 4½d. per thousand, and 293,780 scuffled spots, at 9s. 4d. per thousand. As operations are extended a large area of ploughed ground will become available; and it is more than probable that by letting the pitting of this portion by contract, at 12s. 6d. per thousand, employees will be able to make a satisfactory wage.

The new area planted during the year amounted to 495¼ acres, and the total area under trees at this station is 1,747½ acres, containing 5,124,820 trees.

There were 70,000 trees, principally *Larix europæa* and *Pinus Laricio*, use in replanting previous failures on No. 1 Plantation.

To connect with the main road from Conical Hills to Rankleburn, 20¼ chains of heavy cuttings were made, and not only is much saving of time effected by this direct route, but the conveyance of trees is conducted with a greater measure of safety.

The general maintenance item proved to be a somewhat large one; this, however, might only be expected for the two or three years immediately succeeding the actual planting work. Tree-pruning, removing coarse undergrowth from around trees, cartage of fuel, ploughing of fire-breaks, and replanting failures have all been included under this heading.

The area enclosed by the wire-netting fence some three years ago, for extension purposes, was notorious for the number of rabbits it contained, and, although different measures for exterminating the pest have been constantly in operation, it is necessary to still apply all energies available, in the form of trapping, hunting, and poisoning.

A temporary subdivision fence, enclosing approximately 400 acres, will require to be erected shortly, and by the time this area is planted the complete eradication of rabbits is anticipated.

On the foreman vacating the old house on No. 2 Plantation, the employees were offered, and accepted, the use of the building. As hut-accommodation for only twelve men has been provided at this station, this idea was the wisest solution of the difficulty, and saved any expenditure on buildings that might have followed.

Details of expenditure for the year are appended.

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	11,877	12	0
Pitting	582	12	5
Tree-planting	802	15	0
Cartage of trees	43	0	6
General upkeep of plantation	611	5	7
„ repairs	32	3	7
Horse-feed purchased and transferred from Gimmerburn	25	12	0
Buildings, additions to cottage	24	16	2
Tools, implements, &c.	8	17	0
Miscellaneous works	60	9	4
Salaries—			
Plantation foreman	210	0	0
Nurseryman's proportion of	35	0	0
Supervision	25	10	0
	£14,339	13	7

H. Howe, Plantation Foreman.
R. G. Robinson, Superintending Nurseryman.

Waitahuna Plantation, Otago.

(Dredged area, 12 acres; altitude, 331 ft.)

It is very gratifying to be able to report of the favourable progress generally that is being made by trees growing on this experimental dredged area.

The growth of larch, English birch, and alder is almost phenomenal. A great number of these trees have already reached a height of 10 ft., and present a strikingly healthy appearance. It is rather unfortunate, however, that such trees as *Acer saccharum* and *Fraxinus excelsior* were included in the original selection, as these varieties have proved to be entirely unsuitable for existing conditions, and by their failure to succeed a most irregular appearance is given to the plantation.

In replacing the mentioned undesirable varieties, 11,500 trees, comprising larch, birch, *Pinus Laricio*, and alder were used, and an excellent "strike" has resulted.

Converting abandoned dredged areas into forests must at all times be an expensive undertaking, when the eradication of gorse, usually connected with mining reserves, is taken into consideration.

There was £11 12s. expended in removing gorse and broom that was interfering with the progress of trees, replanting, and general maintenance work.

Probably £6 will meet requirements for maintenance work during the ensuing year, and, as the "leaders" should then be sufficiently high to escape injury from gorse, an annual expenditure of a very small amount should suffice to keep the reserve in order.

The Department is indebted to a local resident who kindly furnishes periodical reports relating to tree-growth, &c.

Amended is a statement of expenditure for the year, and to date.

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	183	0	9
General upkeep of plantation	11	12	0
Supervision	2	0	0
	£196	12	9

R. G. Robinson,
Superintending Nurseryman.

EWEBURN NURSERY, NEAR NASEBY, OTAGO.

(Area, 49 acres; altitude, 1,400 ft.)

The rainfall during the year has been very slight, the total being 13·98 in. on eighty-six days, and maximum fall being 1·64 in., on the 21st January of the present year. The highest reading of the thermometer was 95° (in shade) on the 22nd December, and the lowest 11° (21° of frost), on the night of the 20th June. Frosts occurred on 131 nights.

Although the season has been a very dry one, and accompanied by heavy winds, the growth of nursery stock has been very satisfactory. The probable number sufficiently advanced for transferring will be 400,000.

Seeds were sown as usual in October, and produced 698,800 sturdy plants from 110 lb. of seed; the only variety that did not germinate was larch, and I may say that this is the first time that we have not managed to get a strike of this variety.

There were 667,000 trees lined out, at an average cost of 2s. 3d. per thousand.

The number of trees sent to Government plantations was 199,975, their value being £532 10s. 2d.

The number of trees sent out to date amounts to 2,764,352, and their value is £6,580 9s.

The number of trees in nursery at 31st March, 1909, was 1,991,650, and these are valued at £3,539 6s. 9d.

Details of same may be found in Schedules 1 to 5.

The average number of hands employed was five (day-labour).

Appended are the meteorological records for the year:—

Month.	Rainfall.	Number of Days Rain fell.	Maximum Temperature.	Date.	Minimum Temperature.	Date.
1909.	Inches.		Degrees.		Degrees.	
April	1·33	5	68	20th	24	19th
May	0·51	5	68	23rd	23	17th
June	2·07	9	66	3rd	11	20th
July	1·06	7	62	3rd	18	7th & 14th
August	0·31	7	63	29th	21	12th
September	0·76	8	70	30th	20	2nd
October	1·24	10	72	11th	20	16th & 17th
November	1·11	9	78	10th	30	5th
December	0·73	5	95	22nd	34	19th
1910.						
January	2·52	8	87	26th	37	13th
February	1·85	3	87	6th	36	16th & 17th
March	0·49	10	83	1st & 9th	18	29th
Totals	13·98	86	...	...	...	...

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	10,311	15	6
Tree-growing	377	6	2
General maintenance and repairs	172	19	6
Horse-feed, purchased and grown	41	15	3
Tree-seeds	19	7	4
Fuel	7	12	11
Tools, implements, &c.	7	1	9
Nursery-formation	0	15	0
Proportion of Nurseryman's salary	126	0	0
Supervision	17	0	0
	£11,081	13	5

Value of Stock, Improvements, &c.

	£	s.	d.	£	s.	d.	£	s.	d.
Amount at 31st March, 1909				7,589	1	1			
Less value of trees at 31st March, 1909	2,627	4	10						
Less horse-feed in stock at 31st March, 1909	15	10	0						
Less tools written off during year	31	1	3						
				2,673	16	1			
Carried forward							4,915	5	0

Value of Stock, Improvements, &c.—continued.

	£	s.	d.
Brought forward	4,915	5	0
Trees, as per Schedule 1	698	16	0
" " 2	763	6	0
" " 3	1,505	7	9
" " 4	571	17	0
Tools and implements	7	1	9
Improved value	143	0	0
Horse-feed in stock	21	10	0
Value of young horses bred or increased value during year ...	10	0	0
	£8,636	3	6

Summary.

	£	s.	d.
Value of present stock and general improvements	8,636	3	6
Value of trees sent out since initiation	6,580	9	0
	15,216	12	6
Expenditure to date	11,081	13	5
Credit balance	£4,134	19	1

Stock in Hand.

SCHEDULE 1.—Details of One-year-old Trees, grown 1909–10. (Fourteenth Crop.)

Name of Tree.	Number in Seed-beds.	Height in Inches.	Amount of Seed sown.	Value per Thousand.	Total Value.	Remarks.
			Lb.	£ s. d.	£ s. d.	
Pinus Laricio	600,000	1½	80	1 0 0	600 0 0	Fine crop.
" ponderosa	98,800	1½	10	1 0 0	98 16 0	"
Totals	698,800	..	..	..	698 16 0	

SCHEDULE 2.—Two-year-old Trees, grown 1908–9. (Thirteenth Crop.)

Name of Tree.	Number in Seed-beds.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
			£ s. d.	£ s. d.	
Pinus Laricio	340,000	3–4	1 5 0	425 5 0	Strong plants.
" Benthamiana ..	43,200	3–4	1 10 0	64 16 0	"
" ponderosa	106,000	3–4	1 10 0	159 0 0	"
Larix europæa	91,400	4–8	1 5 0	114 5 0	Fair results.
Totals	580,800	..	..	763 6 0	

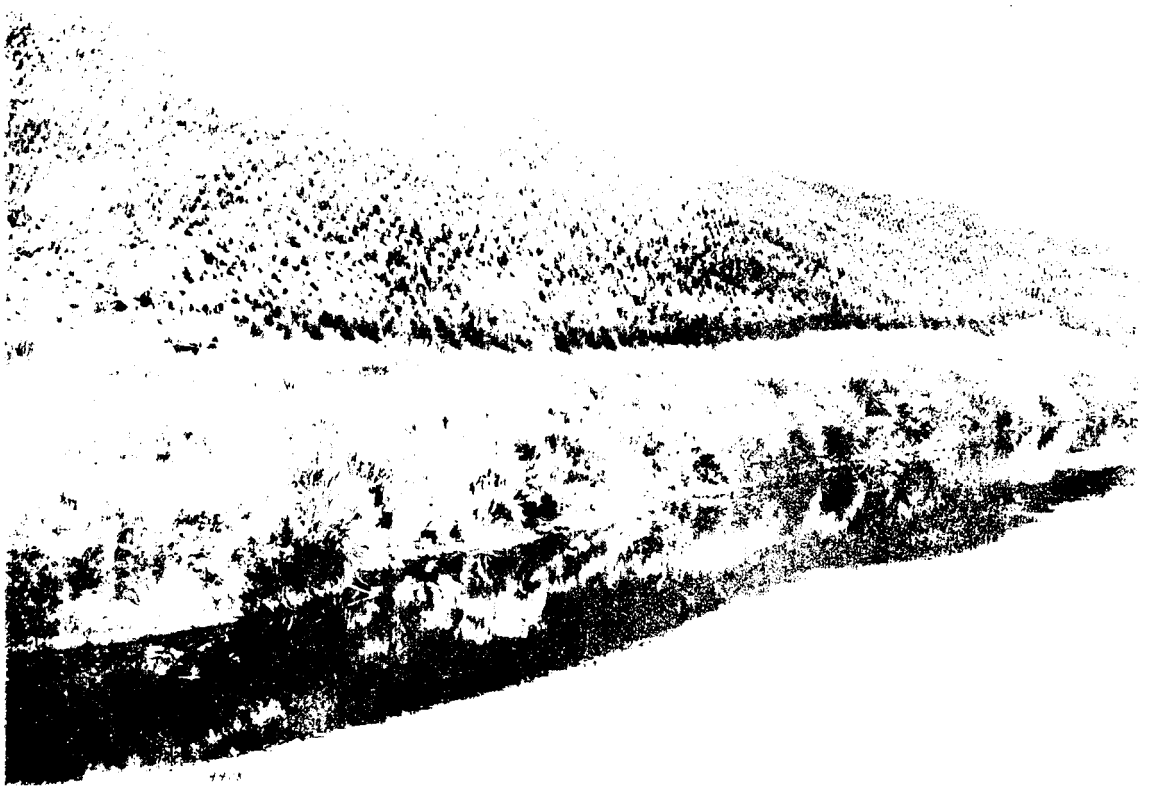
SCHEDULE 3.—Three-year-old Trees, grown 1907–8. (Twelfth Crop.)

Name of Tree.	Number in Seed-beds.	Number in Lines.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
				£ s. d.	£ s. d.	
Pinus Laricio	150,000	245,900	4–5	2 0 0 / 3 0 0	1,037 14 0	Fair growth.
" Bethamiana ..	..	25,750	8–10	3 5 0	83 13 9	Strong growth.
" ponderosa	..	26,850	6	3 0 0	80 11 0	"
Larix europæa ..	..	101,150	8–24	3 0 0	303 9 0	"
Totals	150,000	399,650	..	..	1,505 7 9	
	549,650					

SCHEDULE 4.—Four-year-old Trees, grown 1906–7. (Eleventh Crop.)

Name.	Number in Lines.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
			£ s. d.	£ s. d.	
Pinus Laricio	157,500	6–15	3 10 0	551 5 0	Strong plants.
" Jeffreyii	1,000	8–12	3 10 0	3 10 0	"
Betula alba	450	24	3 10 0	1 11 6	"
Pyrus aucuparia	3,450	27	4 10 0	15 10 6	"
Totals	162,400	..	..	571 17 0	

TAPANUI NURSERY.



A ROCKY FACE PLANTED WITH LARCH AND PINES (CONICAL HILLS).

To face p. 44.

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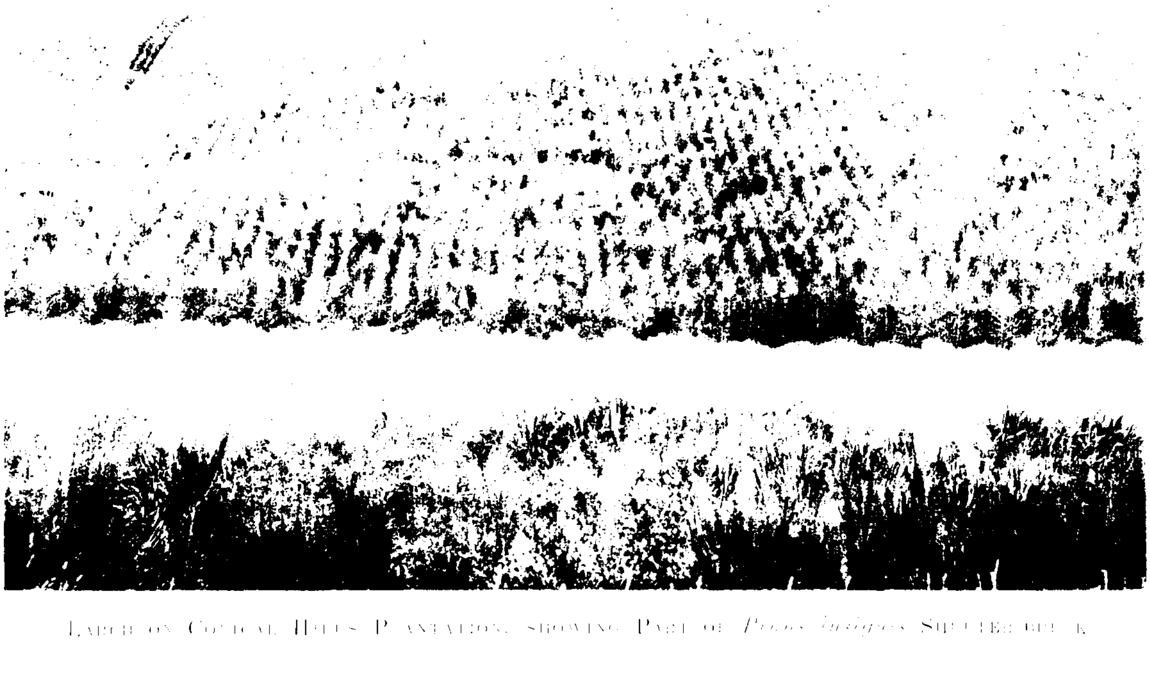

LARCH ON CONICAL HILLS PLANTATION, SHOWING PART OF *Pinus insignis* SHELTER-BELT.

SCHEDULE 5.—Trees transferred from Eweburn Nursery to Plantations, 1909–10.

Where sent.	Name of Tree.	Number.	Value per Thousand.	Total Value.	Remarks.
			£ s. d.	£ s. d.	
Gimmerburn Plantation	Pinus austriaca ..	38,900	3 0 0	116 14 0	Used for planting previous failures.
	" Benthamiana ..	5,000	3 5 0	16 5 0	
		43,900		132 19 0	
Naseby Survey Paddock	Pinus ponderosa ..	46,350	3 0 0	139 1 0	Number of these were heeled in.
	" Bethamiana ..	9,025	3 5 0	29 6 7	
	Larix europæa ..	40,525	1 5 0	50 13 1	
	" " ..	60,175	3 0 0	180 10 6	
		156,075		399 11 2	
Totals		199,975	..	532 10 2	

A. W. ROBERTS,
Nurseryman in Charge.

GIMMERBURN PLANTATION RESERVE.

(Area, 1,200 acres; altitude, 12,000 ft.)

During the year trees to the number of 43,900 were planted out, at an average cost of 16s. 6d. per thousand; this includes pitting and planting. These trees have been used for filling in blanks, and have been very successful.

Oats to the value of £44 4s. were transferred to Tapanui and Hanmer Springs Nurseries, and oaten sheaf to the value of £18 to Eweburn Nursery, making a total of £72 4s.

As there has been no new area planted, the acreage remains at 173¼ acres.

About 50 acres is to be broken up and sown down in oats for the supply of horse-feed to other nurseries.

The workmen's hut was covered with corrugated iron, and is now much more comfortable.

The expenditure for the year amounts to £152 14s. 3d., and the total to date is £2,519 0s. 5d.

An average of one man was employed throughout the year.

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	2,366	6	2
Tree-planting	36	7	10
Cartage of trees	5	4	0
General upkeep of plantation	57	9	0
Horse-feed purchased and grown	11	10	0
General repairs	9	13	5
Proportion of Nurseryman's salary	30	0	0
Supervision	2	10	0
	£2,519	0	5

A. W. ROBERTS,
Nurseryman in Charge.

NASEBY SURVEY PADDOCK PLANTATION (INCLUDING COMMONAGE).

(Area, 300 acres; altitude, 1,900 ft.)

The trees at the above plantation have made very satisfactory growth for the year on the old site, and those planted on the Naseby Commonage Block have also done very well.

Owing to an objection being raised by the Miners' Association and Commonage Committee, the area recently acquired has been abandoned in the meantime, and, in consequence, trees have suffered severely through the fact of rabbits and cattle having access to the enclosure.

If the plantation is to be continued in this locality, I would recommend that land be taken in higher up, as the conditions applicable to this area is equally suitable for tree-planting.

Trees to the number of 156,075 were transferred from the nursery, and 2,500 from Tapanui Nursery, the latter being for experimental purposes.

Owing to instructions being received to desist planting, only 65,925 trees were planted, leaving a balance of 93,150 still in the trenches.

The season has been one of the driest experienced for years, and in consequence a large number have died in the trenches, the larch being the variety that suffered most severely.

There were 65,925 trees planted, at an average cost of 13s. 3d. per thousand; and 128,100 grubber pits were made, at a cost of 14s. 7d. per thousand, by day-labour.

The number of trees in the plantation (including Commonage Block) up to the 31st March was 443,725.

The area planted for the season is 20 acres, making a total of 163 acres under forest trees.

The expenditure for the year is £510 16s. 6d., and the total to date £277 9s. 1d.

Average number of men employed, three (day-labour).

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	2,266	12	7
Tree-planting	54	0	8
Cartage of trees	10	8	0
Pitting	93	12	2
General maintenance and repairs	118	9	0
Fencing	158	3	5
Dismantling commonage fence, &c.	24	15	6
Buildings—erection of hut	13	11	9
Tools	0	6	0
Proportion of Nurseryman's salary	30	0	0
Supervision	7	10	0
	£2,777	9	1

A. W. ROBERTS,
Nurseryman in Charge.

HANMER SPRINGS NURSERY.

(Area, 40 acres; approximate altitude, 1,225 ft.)

Rain fell on 139 days, with a total of 43·74 in., the maximum monthly fall being 6·27 in. in January. The highest shade temperature was 90°, on the 27th January, and the lowest 20°, on the 14th July.

The weather conditions prevailing throughout the past season have been exceptionally favourable for nursery operations. The rainfall was very evenly distributed throughout the year, resulting in a steady unchecked growth among all nursery stock, especially the two-year-old larch, which have put on from 24 in. to 30 in. Three-year-old stock of all classes have made exceedingly good growth, the crop throughout being very sturdy, and in first-class condition for planting permanently in the plantation.

About five and a half beds of last year's seedling larch were partially thinned, a portion of the crop being lined out and the remainder left in the seed-beds for the season, with very satisfactory results.

Owing to a large number being too small and tender for lining-out, lining-in was resorted to with excellent results, and a very large percentage are strong enough for permanent planting.

A "break" of four-year-old *Pinus Laricio* and *P. austriaca* has done remarkably well, and, though these trees were severely checked by wrenching during the summer, they have made an average growth of from 12 in. to 24 in.

Lining-out operations were commenced on the 24th August, but owing to wet weather this work was considerably prolonged, and was not completed until the 21st October. The results have, however, been highly satisfactory, and a total of 1,262,000 trees were lined out, at a cost of 1s. 4d. per thousand. 529,300 smaller plants were also lined in at 1s. per thousand, thus making a total of 1,766,300 trees transferred to nursery lines.

Seed-sowing was commenced on the 4th November, and completed on the 6th, the whole operation occupying three days. The results have been successful, and all seeds germinated well, with the exception of larch, which is not so heavy a crop as in previous years. The crops of *Pinus Laricio*, *P. ponderosa*, and *P. muricata* are heavy, and possess a strong and healthy appearance. Alder germinated thinly, but have made good growth.

The number of trees raised from seed during the year was 2,935,000, valued at £2,934 5s., bringing the total of trees raised since the inception of nursery to 10,275,531, valued at £14,249 7s. 7d. Trees to the number of 1,040,455, valued at £3,124 10s. 7d., were transferred to the plantation during the year, making a total of 3,348,001 trees, valued at £8,713 9s. 1d., transferred to plantation to date.

The estimated number of trees available for transfer to plantation is 1,390,000.

Draining of lining-out area was completed with beneficial results to nursery stock, and soil was rendered easier to plough and work when lining-out. It is proposed to deal with a portion of the new nursery in the same manner, as the greater part is low lying, and water lies for some time before soaking away. The lining-out area was also levelled where necessary, and about 2 chains of new road formed.

As hares do a considerable amount of damage to lined-out stock during the winter, it will be necessary to erect netting fence around the new nursery area against this pest.

The water-supply continues satisfactory, and an adequate pressure can always be relied upon at the nursery. The supply at the stables and house, however, is not so satisfactory, being obtained from an old water-race. A ram is utilised to pump water into a tank situated on an elevation above the house and stables, but the pressure is poor.

Additions to implement-shed were completed, and there is now room for all implements, drays, &c. The present workshop is, however, quite inadequate for requirements, and a small extension is desirable. The building of additions to nurseryman's cottage was commenced in February, and good progress was made with the work. When complete the dwelling should be a vast improvement on the former structure.

For the purpose of providing horse-feed for the winter a paddock of 8 acres was sown during the spring with assorted grasses, and a good crop resulted. About 15 acres of oats were sown during the autumn, the crop being harvested during January.

A yield of 40 tons of excellent sheaf oats was received and stacked in readiness for chaffing as required. About 18 tons of hay were harvested, and about 3 tons of carrots and swedes grown. 400 bushels of feed-oats were received from Eweburn Nursery.

The average number of men employed during the year was 7·66.

Statements of expenditure and values are appended.

The following is a record of rainfall and temperature for the year:—

Month.	Rainfall.	Number of Days Rain fell.	Maximum Temperature.	Date.	Minimum Temperature.	Date.
1909.	Inches.		Degrees.		Degrees.	
April	2·05	7	78	6th	25	28th and 29th
May	3·17	11	67	1st	29	14th
June	1·93	11	68	5th	27	9th and 10th
July	2·84	16	60	20th and 21st	20	14th
August	3·48	19	69	26th	22	8th
September	4·11	14	65	25th	25	23rd
October	3·42	9	72	11th	28	18th
November	3.25	13	75	11th and 17th	32	15th
December	6·01	10	83	25th	39	14th
1910.						
January	6·27	11	90	27th	43	2nd and 6th
February	1·55	4	83	12th	36	16th
March	5·66	14	80	8th	29	21st
Totals	43·74	139	...	...	...	...

Statement of Expenditure.

	£	s.	d.
Amount at the 31st March, 1909	5,514	1	8
Tree-growing	650	19	2
General maintenance and repairs	98	6	11
Nursery-formation	64	17	10
Horse-feed purchased and grown	79	1	4
Manures	2	13	5
Tree-seeds	60	2	8
Tools, implements, &c.	20	13	7
Water-supply	42	17	10
Buildings—erection of shed, part house, &c.	80	13	10
Fencing	2	2	0
Miscellaneous works	35	17	6
Proportion of Nurseryman's salary	150	0	0
Supervision	35	0	0
	£6,837	7	9

Value of Stock, Improvements, &c.

	£	s.	d.	£	s.	d.	£	s.	d.
Amount at 31st March, 1909 ...				9,690	11	5			
Less value of trees at 31st March, 1909	7,033	18	0						
Less horse-feed in stock at 31st March, 1909	160	0	0						
				7,193	18	0			
							2,496	13	5
Trees, as per Schedule 1							2,934	5	0
" " 2							4,533	4	6
" " 3							1,148	9	0
" " 4							364	0	0
Tools and implements							20	13	7
Water-supply							42	17	10
Nursery-formation							64	17	10
Fencing...							2	2	0
Buildings							80	13	10
Improved value							185	0	0
Horse-feed in stock							200	6	4
Value of young horses bred and received from Starborough Nursery							90	0	0
							£12,163	3	4

Summary.

	£	s.	d.
Value of present stock and general improvements	12,163	3	4
Value of trees sent out since initiation of nursery	8,713	8	1
	20,876	11	5
Expenditure to date	6,837	7	9
Credit balance	£14,039	3	8

Stock in Hand.

SCHEDULE 1.—Details of One-year-old Trees, grown 1909–10. (Eighth Crop.)

Name of Tree.	Number in Seed-beds.	Height in Inches.	Seed Sown.	Value per Thousand.	Total Value.	Remarks.
			Lb.	£ s. d.	£ s. d.	
Larix europæa	1,200,000	4	150	1 0 0	1,200 0 0	Thin crop.
Pinus Laricio	1,500,000	2	100	1 0 0	1,500 0 0	Germinated well.
„ ponderosa	220,000	1½	20	1 0 0	220 0 0	Well-grown plants.
„ muricata	12,000	4	1	1 0 0	12 0 0	„
Alnus glutinosa	3,000	3	½	0 15 0	2 5 0	„
Totals	2,935,000	..	..	..	2,934 5 0	

SCHEDULE 2.—Two-year-old Trees, grown 1908–9. (Seventh Crop.)

Name of Tree.	Number in Seed-beds.	Number in Nursery Lines.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
				£ s. d.	£ s. d.	
Larix europæa	390,000	935,000	18	1 5 0 / 2 5 0	2,591 5 0	Strong plants.
Pinus Laricio	..	505,000	3	2 5 0	1,136 5 0	Good growth.
„ ponderosa	..	275,600	2½	2 5 0	620 2 0	„
„ Benthamiana	..	58,500	2	2 10 0	146 5 0	„
„ muricata	..	4,600	10	2 5 0	10 7 0	„
Pseudo-tsuga taxifolia ..	..	9,000	10	2 10 0	22 10 0	Satisfactory.
Chamaecyparis Lawsoniana ..	..	780	8	3 15 0	2 18 6	„
Thuja gigantea	..	1,200	5	3 0 0	3 12 0	„
Totals	390,000	1,789,680	..	..	4,533 4 6	
	2,179,680					

SCHEDULE 3.—Three-year-old Trees, grown 1907–8. (Sixth Crop.)

Name of Tree.	Number in Nursery Lines.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
			£ s. d.	£ s. d.	
Pinus Laricio	345,800	10	3 0 0	1,037 8 0	These plants are all well-grown.
„ ponderosa	31,900	10	3 0 0	95 14 0	Ditto.
Robinia pseudo-acacia	5,500	20	2 10 0	13 15 0	„
Cotoneaster Simmondsii	800	24	2 0 0	1 12 0	„
Totals	384,000	..	..	1,148 9 0	

SCHEDULE 4.—Four-year-old Trees, grown 1906–7. (Fifth Crop.)

Name of Tree.	Number in Nursery Lines.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
			£ s. d.	£ s. d.	
Pinus austriaca	81,000	20	3 10 0	283 10 0	Left from last year.
„ Laricio	23,000	20	3 10 0	80 10 0	„
Totals	104,000	..	..	364 0 0	

SCHEDULE 5.—Trees transferred from Hanmer Springs Nursery to Plantation, 1909–10.

Name of Tree.	Number.	Height in Inches.	Value per Thousand.	Total Value.	Remarks.
			£ s. d.	£ s. d.	
Larix europæa	691,375	16	3 0 0	2,074 2 6	These trees have all done well.
Pinus Laricio	268,280	12	3 0 0	804 16 9	
" ponderosa	53,200	13	3 0 0	159 12 0	
Pseudo-tsuga taxifolia	12,675	10	3 5 0	41 3 10	
Betula alba	8,500	36	3 0 0	25 10 0	
Alnus glutinosa	6,425	18	3 0 0	19 5 6	
Totals	1,040,455	..	..	3,124 10 7	

W. G MORRISON,
Nurseryman in Charge.

HANMER SPRINGS PLANTATION.

(Area, 2,568 acres; altitude, 1,225 ft.)

The past season has been one of the most successful on record at this station, the death-rate among trees being very low, and chiefly confined to a block of larch, which was planted rather late in the season. Tree-growth throughout the plantation has been exceptionally good, and much above the average of previous years.

The total number of trees planted during the year was 1,040,455, including 121,629 used to replace blanks. The area planted was 337½ acres, bringing the total under trees to 1,213½ acres, containing 3,350,056 trees.

Free Labour.—The average number of men employed on day-labour was 3·26, and on contract work 6·33. Pitting cost 15s. per thousand, and tree-planting 10s. per thousand by contract and 12s. 8d. per thousand by day-labour.

About twelve miles of fire-breaks were ploughed and cultivated, and some of this work was carried out in almost inaccessible places. Two fire-breaks, each a chain wide and a mile in length, were also laid out on the newly acquired area, the remaining portion of the old block, consisting of about 70 acres, was cleared of scrub and pitted in readiness for planting. The work of pitting was commenced on the extension area, and good headway has been made. A total of 543,050 pits were dug, and 77,750 trees planted after the area had been cleared of scrub.

Cleaning around young trees was carried on where necessary, and general pruning pushed on throughout the plantation.

Replanting of failures also engaged attention, and the coming season should see this work completed on the old area. Larch of all ages have again made rapid growth, and trees established have put on a vertical growth of from 18 in. to 50 in. Pines of all varieties continue to do well, and have made excellent progress. The average growth of trees planted during the year is about 4 in., and that of established trees about 20 in.

The number of pits available for tree-planting is 251,000. Some damage was done to young trees by rabbits and hares, but these pests are now under control, very few being inside the fenced areas.

Ploughing of fire-breaks was again successful, no damage being done by fire.

Prison Labour.—Details and values of work done by prisoners are as follows: Average daily number employed at forestry work, 13·5; pitting for tree-planting, 260,201 pits; £195 3s.; tree-planting, 841,076, £532 13s. 6d.; formation, £14 4s. 9d.; clearing for tree-planting, £61 6s. 6d.; general maintenance work, £9 18s. 11d.; horse-feed, £2 2s.; fencing, £1 12s. 6d.

Total value of work done, £817 1s. 2d.

Details of expenditure for the year and to date are appended.

Statement of Expenditure.

	£	s.	d.
Amount at 31st March, 1909	5,684	1	6
Pitting	406	5	11
Tree-planting	49	4	8
Clearing	112	4	0
Cartage of trees	22	6	6
General upkeep of plantation	262	0	1
Horse-feed purchased and grown	45	11	0
Tools, implements, &c.	40	0	3
Miscellaneous works	11	12	0
Salaries—			
Supervision of prison labour	118	10	8
" free labour	59	5	4
Nurseryman's, proportion of	70	0	0
Supervision	25	0	0
	£6,906	1	11

A. J. BOYDELL, Plantation Foreman.
W. G. MORRISON, Nurseryman in Charge.

APPENDIX D.

FOREST-TREE GROWING IN THE ROTORUA DISTRICT.

(By H. A. Goudie, Superintending Nurseryman.)

This article is intended to encourage tree-planting, and it should therefore be remembered that Rotorua is 1,000 ft. above sea-level, and is subjected to extremes of temperature that have caused the failure of many of the species tried. Many intending planters may have a less trying climate to contend with, and a failure of a species at Rotorua does not necessarily mean a failure with them. Our operations will at least give an idea of the hardiest species, as well as a list of the most useful ones. Although failures have occurred at Rotorua, it must not be concluded that the district is unsuitable for afforestation work. On the contrary, those species which we now grow extensively make an annual growth that is not exceeded in any part of New Zealand.

To grow good crops a farmer endeavours to keep his land in good condition by ploughing and cultivating. Land not in use is ploughed and left in the rough state in order to catch all the rain that may fall, and the moisture thus got is retained by frequent applications of the harrows, which causes the surface soil to become dry, and thus act as an insulator in preventing the evaporation of the moisture from the subsoil. Land thus treated, too, is porous, and the roots of the crops grown thereon can easily penetrate it, and reach the stored-up moisture. In forestry operations, such preparations over large areas are too expensive, and when the trees are a few years old, quite impracticable. The forester, however, attains the same result in another way. The soil is protected from the sun and wind as quickly as possible by close planting. In a few years' time the land is covered with a layer of leaves, which allows the rain to penetrate the soil without making it too compact; it is thus kept in a porous condition, and gets the full benefit of the rain and air.

The protection of the soil, then, is one of the principal reasons why trees meant for the production of timber are planted closely. The density of planting varies considerably in different countries, but in New Zealand it has been found that 4 ft. is a suitable distance for most of the pine family. Close planting is also essential for the production of clean straight timber, in that the lower branches become suppressed, wither, and drop off, leaving the trunk quite clean. The lateral growth never really attains a sufficient size to cause a knot in the timber. As a young plantation grows the branches of the trees gradually interlace, so that in time the whole of the land is covered by an uninterrupted canopy of foliage, under which will be found the withered remains of any weed-growth that may have occupied the land before it was planted. This canopy should be maintained throughout the life of the plantation, and kept uniform. Up to a certain age it is found that every tree appears to be thriving and forming new wood annually, but there comes a time when some of the trees are overtopped by others, and are gradually being suppressed for want of light. All the suppressed or dominated trees should then be removed, provided their removal will not cause an interruption in the canopy. The functions of the canopy are the protection of the soil or forest-floor from the drying effects of the sun and the wind, thus conserving the moisture in the soil for the use of the trees, preventing washing away of the soil by breaking the force of heavy rains, and manuring and enriching the soil by depositing leaves which decay and supply food for the trees. The most important function of the canopy, however, is the fixation of carbon.

Trees, and, in fact, most plants under the action of sunlight, collect through their leaves the carbon-dioxide from the atmosphere, and this carbon-dioxide is assimilated by the leaves, and eventually becomes what is known as wood. The process of taking in carbon can only go on under the action of light; hence a tree that has few leaves, or one that is shaded, cannot obtain much food from the atmosphere, and therefore its growth is small. The production of wood is in proportion to the leaf-space of the tree. Light is necessary to all trees, but it is known that some trees are more light-demanding than others, and on account of this peculiarity foresters have divided them into two classes—light-demanding and shade-enduring; and, again, under each of these classes trees have been sorted out in their relative positions. The light-requirements of the various species of trees must be taken fully into consideration in forming and attending plantations. Light-demanding trees thin out at an early age, and do not give sufficient protection to the soil, so that they should either be mixed with a shade-enduring species or underplanted with a shade-enduring species after they have been thinned. A list is appended hereto which shows the different species of trees that have been tried in the Rotorua District, and a glance at this list will show that very few of the economic trees that would be likely to succeed have been neglected.

Yet when we peruse this list it is astonishing how few of those tried are really suitable for extensive cultivation in this district. It will be noticed that almost all the deciduous hardwoods have failed, and these species include some of the most valuable timber trees. A general reason can be assigned for the failures amongst this class, and that is, unseasonable frosts. The temperature in this district not infrequently goes as low as 17° Fahr. during the months of July and August, but this does very little damage, if any. If, however, frost—even 2°—is registered in November, the deciduous trees suffer severely, and as these spring and summer frosts come regularly every year, the trees never get beyond the bush stage.

Extensive experiments were made with *Catalpa speciosa*, but at the present time not a single tree is alive to give evidence of these experiments. The same results are recorded against oak, sweet chestnut, Robina, hickory, butternut, black walnut, English ash, and sugar-maple. The common walnut failed in most localities, but on two small blocks of land on which the bracken grows to a height of 6 ft., these have done passably well. The expense, however, of protecting the young trees from injury by the bracken is very heavy, and it is doubtful if it is a good policy

to plant such land with a slow-growing tree. Many good specimens of the prickly acacia (*Robinia pseudo-acacia*) can be seen in favoured spots in the Rotorua district, but for extensive cultivation it has been found unsuitable on our plantations. Large areas of the land which is being planted is covered with a heavy growth of bracken. This is noticeable mostly in the gullies, where the black soil is not infrequently 18 in. deep and the fern sometimes as high as 9 ft. The shelter afforded by the fern is favourable to the growth of most of the hardwoods; but then we are faced with a heavy annual expenditure—perhaps for eight years—in clearing the fern-growth around each tree. Under such circumstances the growing of these hardwoods is altogether too costly, and has been discontinued for the present. When a plantation of trees reaches a state in which the whole of the land is covered by an overhead canopy of leaves, we find that the frost has no ill effect upon them; and so, if a hardwood plantation could be protected until the crowns of the trees meet, this class of tree could be as successfully grown here as in any other part of the Dominion.

A system of underplanting as adopted on the Continent of Europe would probably give the desired result. This system consists in either sowing or planting a wood that has been regularly thinned until there remains, perhaps, a hundred trees to the acre. The species that it is desired to introduce is sown or planted under these shelter-trees, and when the young crop gives sufficient protection to the soil, the shelter-trees are removed. So far none of our plantations are sufficiently advanced to try this system, but it has been mentioned in order to show that, although these species are not now being planted, future planting will become possible when some of the present areas have matured. Much better results have been got with the conifers, although, amongst this class, the number of successful species is comparatively small. Of the twenty-two millions of trees that are now growing successfully in this district, the principal species are larch, Austrian pine, Corsican pine, western yellow-pine, clear or white pine, remarkable pine (*Pinus insignis radiata*), Oregon pine, birch, and several species of eucalypti. As these kinds generally do well throughout the Dominion, the following information regarding them will perhaps be useful to intending planters:—

Larix Europœa (European larch) has occupied first place in the operations in the Rotoura District. This species is a native of the Alps and the Moravian and Carpathian Mountains. It is easily raised from seed, which can be procured in almost any quantity in Europe. The average number of seedlings produced per pound of seed over a period of five years at Rotorua Nursery was 3,500, and the cost per thousand, reckoned only on the cost of seed, was 8d. It has been found that on elevated situations or else sloping ground this species does best. If planted in hollows or valleys where the warm air-currents during the day are succeeded by very cold night air, the trees are very liable to be frosted during the spring when the young growth appears.

With the exception of *Pinus radiata*, larch is the most rapid-growing tree that has been tried here. A plantation of these at Whakarewarewa, planted in 1901, average 25 ft. in height. The trees, when planted, were seedlings from the two-year-old beds, and averaged 15 in. in height. At the third year from the time of planting they averaged 5 ft. in height. From then on very rapid progress was made, 3 ft. of vertical growth in a year being a common thing, while individual specimens have been measured showing a growth of 52 in. for the year. It will be readily understood that the larch very soon protects the ground, and that the dense growth of bracken usual to this part is soon suppressed. Other species of trees that have been mixed with it when planting have ceased to exist after the fourth year, and there seems to be no alternative but to plant this species pure.

In regard to light-requirements, larch is one of the most exacting of our timber trees, and, judging from the growth made by it in this district, the plantations will probably require a severe thinning about the twelfth year from the time of planting. A second thinning will perhaps be necessary about the eighteenth year; and, as this will expose the land very considerably, it may probably be found expedient to protect the soil by underplanting the larch with a shade-enduring species of timber tree. Either the redwood (*Sequoia sempervirens*) or Oregon pine (*Pseudo-tsuga taxifolia*) will probably be found suitable for this purpose.

The timber of larch is reputed to be the best grown in Britain for construction above and below ground. It is used for fencing, railway-sleepers, and for mining purposes. The Germans make casks of it, and it can also be used for house-building and furniture.

In Great Britain the larch is seriously affected by a fungoid disease (*Peziza Dasyscypha Willkominii*), and for this reason planting with this species is much less general than formerly. The disease, however, has not made its appearance in New Zealand, and as yet the larch plantations are quite as healthy as plantations of other species. Larch presents a miserable appearance wherever planted near the sea-coast, and, generally, will not thrive at an altitude of less than 500 ft.

Larix leptolepis (Japanese larch) has at the present time a somewhat restricted range on the central mountains of Japan, where it is not uncommon at 5,000–6,000 ft. elevation. The wood is hard, heavy, and strong, but not much used on account of the inaccessibility of the trees. This species has been tried at Rotorua, but not to any great extent. In appearance it is somewhat similar to the European larch, but of somewhat slower growth than that species. At the present time it is receiving great attention in Great Britain, as a probable substitute for the European species, on account of its immunity—at least up to the present—from the larch moth and larch disease.

Larix occidentalis (Western larch, or tamarack).—This species is indigenous to the State of Oregon, Washington, Northern Montana, Idaho, and British Columbia. With the exception of a small trial lot raised from seed at Rotorua this year, this species has not been tried by the Department. The information gained is, therefore, somewhat meagre, and at the present time all that can be said of it is that the seed germinated well, but the growth is less vigorous than that of the European species. The following description is taken from Veitch's "Manual of Conifers": "The wood surpasses that of all other American conifers in hardness and strength;

it is durable, beautifully coloured, free of knots, and is adapted to all sorts of construction and for household furniture; it is, however, but little used in the sparsely settled and remote region in which it abounds. The thickness of the bark of this larch enables it to resist the heat of the forest fires, which are fast destroying the noble coniferous trees in the Columbian basin; and, in the struggle for supremacy between the different inhabitants of the Columbia forests under the changed conditions which have followed the white man's occupation of the country, *Larix occidentalis* seems destined to hold its own, and probably even to extend its sway."

Sequoia sempervirens (redwood) is a native of California and Oregon, where it attains a height of from 180–250 ft., and with a diameter at the base of from 12–18 ft. The timber is used for general building purposes, furniture, railway-sleepers, fencing, and joinery. The chief obstacle the Department has had in growing this tree is the difficulty of getting seed of good germinating quality. For several years large quantities of seed were sown regularly, sometimes not a single tree resulting, and on other occasions a fairly good crop being produced. There is no doubt that this is the greatest obstacle to be met with in raising large quantities of this species. The redwood is a very fast grower. At Rotorua the season of growth extends from September to well on in May, and the late spring and early winter frosts are sometimes rather severe on the young growth. The species has, however, marvellous recuperative power, for if the leaders are damaged a new one is produced quite readily. Several specimen trees at Rotorua, nine years old, are 35 ft. in height. The species requires a moist atmosphere, and an equable temperature best suits its proper development. It transplants best in autumn, as it then gets the benefit of the rain during the following winter months. Spring planting has been proved with us to be rather risky, as the planting must be done when the earth and air are moist. Redwood has been planted with nurses of other species, but no mixture that has been tried has proved entirely satisfactory. Our best results have been got by planting the species pure on the hills facing the Green Lake, where, within the influence of this large body of water, the climate is fairly equable and humid.

Pseudo-tsuga Douglasii (*Abieta Douglasii*, Douglas fir, Oregon pine).—Habitat, Washington, Oregon, British Columbia, where under favourable conditions it reaches from 150–200 ft. in height, with a trunk from 4–6 ft. in diameter. Timber is used for general building purposes, and ships' spars. It is heavy, hard, and close-grained, and very strong. This species is easily raised from seed, although the seed-supply is precarious, and frequently poor in quality. The transplanting of young trees must be carefully done, as this species is not as hardy as the majority of the European pines. It has been found that this is not a good species for general planting, but that selected spots of good land in an elevated situation must be chosen in order to get the best results. In situations where the spring frosts are most severe the young growth is usually badly frosted and the plants remain stunted in appearance for years.

Oregon pine may be described as a moderate shade-bearer, but owing to the uneven growth made by the trees it is difficult to choose a species to plant along with it. At Rotorua the growth made by individual trees has equalled that of the larch, but when planted along with that species it needs a lot of protection to prevent it becoming suppressed by the larch. All the trees of this species now being grown by the Department are being planted pure, but when some of the larch areas are well thinned it is proposed to use the Oregon pine for underplanting.

Pinus ponderosa (western yellow-pine) is a native of the western States of North America, where it is very widely distributed. One of the largest of the pines attains a height of from 100–150 ft., with a diameter of from 3–6 ft. Good fertile seed can be readily procured. No particular difficulty is attached to raising young plants, which are moderately quick in growth. Of all the species yet tried by this Department *Pinus ponderosa* has proved to be the hardiest, having thriven equally well in valleys and on the drier land of the hillsides. As regards the rate of growth, it stands midway between the Austrian and Corsican pine. In light-requirements, as far as can be judged from our young plantations, it is similar to the Corsican pine, and on this account pure planting is recommended. The timber is reputed to be heavy, hard, and strong, and to be useful for general building purposes. On account of the wide distribution of this species, many forms have been produced, and these vary greatly in character. The varieties *Jeffreyii* and *scopulorum* are now under trial, but nothing definite can yet be said of them.

Pinus strobus (Weymouth or white pine) is a native of the Great Lakes region of North America, where it attains to a height of from 100–150 ft., with a trunk from 3–4 ft. in diameter at the base. It is one of the most important of the North American timber trees. The timber, which is largely used in Great Britain, is light, soft, not strong or durable in contact with the soil; suitable for cabinet-work, interior finishings of buildings, and for general construction purposes. We have found the seed-supply to be somewhat precarious, and frequently poor in germination. Seed should be mixed with damp sand for a fortnight before sowing, otherwise the germination is protracted over many months. The Weymouth pine is very hardy as regards winter frosts, but suffers from late frosts if planted in damp valleys. Rate of growth, 14 ft. in ten years, and in this respect it stands along with *Pinus ponderosa*. In regard to light-requirements, the Weymouth pine is reputed to stand midway between the light-demanders and shade-bearers, and in this respect it will probably be found suitable for planting under larch. At Waiotapu several areas planted pure with this species have made excellent headway, but when planted with Austrian pine the results are unsatisfactory, on account of the slower growth of the latter species.

Pinus Laricio (Corsican pine) is a native of southern Europe and Corsica. The timber is durable, and in many respects similar to the Austrian pine. Seed is easily procured. Next to larch this pine takes the greatest part in the afforestation operations in the Rotorua District. It is easily raised from seed, but great care must be exercised in transplanting the young trees. To get the best results autumn planting is recommended. This pine produces a long taproot, does not readily develop secondary roots, and if planted in the dormant season—say, June or July—when frost is prevalent, the plants are liable to die. It is a much quicker grower than the Austrian pine, and is not nearly so bushy in appearance, the whorls of branches being much

further apart. In comparison with the Austrian pine it is more light-demanding, quite as hardy when the plants have become established, and adapts itself to land that is poor and inclined to be dry. Equally good results have been obtained with this species in the Waiotapu Valley and on the exposed Kaingaroa Plains.

Pinus austriaca (Austrian pine) is a native of southern Europe. Height, about 75 ft.; trunk slender. The timber is light and soft, very durable, and rich in turpentine. Useful for general construction purposes. Seed is easily procured, large quantities being handled yearly by European seedsmen. Seed usually germinates well, but the trees from the seedling stage until about the twelfth year are comparatively slow-growing. In habit the Austian pine is very compact, producing a great number of branches, and on this account is a most useful shelter-tree. Amongst the species which have been grown in quantity at the Rotorua Nursery it is the slowest grower, and on this account plantings are mostly being made pure. The species which resembles it most in regard to rate of growth, and which is perhaps the best one to mix with it, is *Pinus strobus*, but the latter species starts away quicker after planting, and overtops the Austrian pine, with the result that the leaders of the *Pinus strobus*, which are very brittle, are frequently broken off by the wind.

Eucalypti.—At Rotorua some forty species of this genus have been tried, with various results, and at the present time the only one that is being planted is *E. Stuartiana*. Next to this species in hardiness are *E. pauciflora*, *E. amygdalina*, and *E. globulus*. Such species as *E. marginata* (jarrah), *rostrata* (red-gum), *pilularis* (black-butt) are not hardy enough to survive through the winter frosts in this district.

In all the plantations that have been formed of eucalypti the trees have been planted 6 ft. apart in quincunx order, and in every case hilly country has been selected for the purpose. Most of this country as it comes under our hand is densely covered with fern and tutu, which has to be burned off before planting can be proceeded with. This natural growth is not done with, however, when it is burnt off, but again grows almost as strongly as before, with the result that the young trees are soon choked up. Having this heavy weed-growth to contend with, it is necessary that a species of tree that is fast-growing should be selected, and this, combined with its hardy qualities, is the principal reason why *E. Stuartiana* has been chosen to represent the Australian hardwoods in our plantations. It is easily raised from seed, and transplants well. After *E. Stuartiana* the next most satisfactory species is *E. pauciflora*, but this species is somewhat slower-growing, and in this respect entails more labour in keeping the fern-growth from choking the young trees. *E. amygdalina* is less hardy on account of its growing well into the autumn, when early frosts cut back the young growth. *E. globulus* (the common blue-gum) is perhaps the hardiest of all the eucalypti, but has been discarded by us on account of the damage done to the trees by a leaf-eating caterpillar.

Pinus radiata (insignis). This tree is too well known to require a description here. In almost every part of New Zealand it has been largely planted for shelter, and for this purpose it is admirably adapted on account of its rapid growth. In Canterbury the timber of this pine has been used for farm buildings with satisfactory results. It is also useful for making packing-cases, and experiments made in Canterbury some years ago show that butter-boxes made with it are entirely satisfactory. On account of its rapid growth, *Pinus insignis* will yield an early return in timber, and the produce would probably find a ready market in most of the dairying districts, where it should be largely grown to take the place of Kahikatea. It is not a durable timber, and makes an inferior fuel.

Betula alba (English or silver birch) is a native of northern and eastern Europe. The timber is used in Great Britain for firewood, charcoal for gunpowder, bobbins, herring-barrels, and other similar purposes. It is not durable in contact with the ground.

Birch has occupied but little attention in the operations of this Department, its use being confined to planting dry hill-tops, where other trees would not grow, and for shelter and ornamental effect.

Mixed or Pure Plantations.—A pure plantation consists of trees of one species only, while a mixed plantation may consist of two, three, or more species. A pure plantation is more easily formed and managed than a plantation consisting of several species, each of which requires different treatment; but, on the other hand, if it is intended to grow large-sized timber, many of the valuable trees cannot be grown pure, on account of their opening out at an early age and exposing the soil to the deteriorating influence of the sun and wind. This is the case with such light-demanding species as larch and oak. Pure plantations can be recommended only if it is intended to cut out the plantation at an early age for such purposes as firewood, or if there is a market for small-sized timber. Again, on most blocks of land certain portions are suitable for one species only—for instance, wet land may be planted only with alder. Light-demanding species may be planted pure, provided that when they reach a state in which they do not give sufficient protection to the soil the soil be protected by underplanting. Shade-enduring species may be planted pure, and no advantage is gained by mixing unless it be a tender species requiring the protection of a more hardy one, or a species liable to a disease which would be mitigated by mixing.

The advantages of mixed planting over pure planting may be briefly stated as follows: Mixed planting permits of a greater variety of timber being grown where the area available for planting is small. Species that, owing to their thin crowns, fail to protect the soil if planted pure can be grown to maturity if mixed with a soil-protecting species. Diseases peculiar to conifers may be mitigated if hardwoods are mixed with the conifers. Tender species that require protection when young are benefited by mixing them with a hardy species to act as nurses. Undoubtedly mixed plantations have more to recommend them than pure plantations; but in the Rotorua District it has been found a most difficult matter to get two species that will grow well in mixture. Another difficulty—and this may be said to apply to New Zealand as a whole—

is the uncertainty of getting supplies of the seed of several species. Any plans that are laid down for planting are upset if the supply of the seed of a species fails, the distance we are from the big seed markets making it quite impossible to make other arrangements in time. Suppose, for example, it is desired to plant an area with larch and Douglas fir in mixture: The larch-seed is procured without difficulty, while the Douglas fir seed-crop is reported as a failure, or partial failure. We subsequently have an abundance of larch plants and no Douglas fir, and both species must be even aged to succeed in mixture; or if any difference in the ages of the two species is permissible, the Douglas fir should be the older of the two. Supplies of seed of European species are much more certain than the American species.

Although the general principles of sylviculture are applicable to any part of the world, the influence of the locality upon tree-growth must be taken into consideration in determining the species that may be successfully grown in mixed plantations. At Hanmer Springs larch and Menzies' fir do well together; but in the Rotorua District larch makes marvellously quick growth, while the Menzies' fir will not thrive unless planted under the shade of other trees. When planted along with larch, Menzies' fir make perhaps 1 in. growth a year for four years, while the larch has attained such a height as to completely smother them. Larch along with redwood has also been a distinct failure. The redwood, although naturally a quick grower—isolated specimens comparing favourably with the larch in this respect—does not readily recover after transplanting, being somewhat tender, with the result that the larch soon kills them outright. Larch and Douglas fir has proved a better mixture, but while one Douglas fir will hold its own with the larch there may be ten other trees that the larch overtops and suppresses. Our experience is that the larch must be planted pure.

Many specimens of growing trees for timber purposes are practised in the older world, and it is here proposed to give a brief description of the various methods employed, in order that the aims of the Department may be understood. In New Zealand we have had an abundance of timber suitable for almost all purposes, from general building timber to those kinds suitable for cabinetmaking. The latter class of timber is by no means exhausted, as many of our indigenous trees suitable for furniture-making have been almost entirely neglected; so that it is thought our Forestry Department's efforts should first be directed towards producing a supply of timber suitable for building purposes, to take the place of the rapidly disappearing kauri, rimu, &c., leaving the growing of the kinds especially suitable for furniture to a future date. Judging from the present state of the industries which use timber in this country, it does not appear desirable that timber of a small size should be produced, and therefore it is proposed to adopt, within certain limits, the system of high forest, or, in other words, a system that will enable the trees to grow into a large-sized timber. Against this there is the coppice system, by which material of a small size is produced. Trees that can be grown under the coppice system are those which, when cut down, make fresh growth from the stump or root, and this class includes such species as oak, ash, alder, willow, &c. A coppice plantation is formed by either sowing or planting in the ordinary manner. The purpose for which the timber is to be grown determines the size to which the trees are to be allowed to grow, and whenever the desired size is reached the plantation is cut clear. From the stumps which remain in the ground fresh saplings are produced. These are thinned to the desired density, and from what then remains a fresh crop of timber is in time produced. Such a system produces timber suitable for firewood or charcoal, tool-handles, basket-making, implement and vehicle frames. Oak is often grown in this manner for the sake of the bark, for tanning. At the present time a ready market could be found for New-Zealand grown English ash of almost any size. It is admirably suited for wheels, tool-handles, frames for vehicles, &c., being both tough and elastic. The supply of American ash handles has steadily become less plentiful and more costly, until at the present time other less suitable timbers are being used in place of it. The quantity of handles for slashers, picks, hammers, and similar purposes imported annually into New Zealand must be very large, and the time is coming when such articles will be too costly to buy.

Coppice plantations would also be a good investment in districts where firewood is scarce, the advantage of this system over one which includes the growing of conifers being the rapidity with which a new crop is produced if the trees are cut in the proper season. Several methods of growing coppice plantations can be adopted, but in each the principles of simple coppice already described are identical. In districts where the broad-leaved trees are liable to be frosted, shelter plantations of a hardy conifer such as larch could first be grown, and after it is well thinned the species for coppicing could be introduced by underplanting. Such a system permits of the production of both large and small timber on the same area. The shelter-trees, which should be selected from the light-demanding species, have space to develop, and, while giving protection to the under-trees, they in return have the benefit of the protection given to the soil by the under-trees. Where the climatic conditions are suitable this two-storied system can be attained by first producing a simple coppice plantation, and when the cutting commences leaving a number of trees at even distances to remain as shelter for the subsequent crop of underwood.

High Forest.—As has already been stated, this term covers a number of systems, in all of which the object aimed at is the production of large timber. It is proposed to here give a brief description of several systems of growing trees into large-sized timber, but first of all two points which are essential in each method will be recalled. The protection of the soil from the sun and wind by the leaf-canopy is essential for success by each of any of the systems that are adopted. By crowded planting the soil is quickly protected, and the height-growth of the trees is favoured, while the suppression of the branches necessary for the production of timber free from knots is assured.

Clear-cutting High Forest.—A plantation is raised in the usual way. It is tended by way of thinning, and when the trees have reached a marketable size the whole area is felled, and the process of growing a further crop is repeated as before. The production of timber grown under

this system, provided that the thinning has been carefully done, is considered to be equal to that of any other system, and it has the advantage over some of the other systems in that the produce is more easily removed from the ground. Where climatic conditions make it difficult to grow trees on cleared land this system should not be adopted. In districts where the rainfall is small the soil becomes hard and parched, and the trees have a struggle for existence until they are large enough to protect the soil from the sun and wind. Again, this condition would recur when the plantation has been well thinned, and would be prejudiced to the development of the trees into a large size. The soil will always deteriorate from exposure, and on hilly country it is liable to be washed away, so that the benefit of the accumulation of humus left by the first crop is lost to the next crop. Clear cutting is suitable only where the rainfall is sufficient, the land good, and the climatic conditions otherwise favourable to the growing of young trees. Another method in which clear cutting is adopted is to first form a plantation of a light-demanding species. When this is thinned sufficiently it is underplanted with a shade-enduring species, which is allowed to grow up amongst the original crop in a two-storied fashion until both the first and second crops are of equal height and of marketable size, when it is clear cut.

The other systems of growing high forest all provide for the formation or regeneration of the forest under the old crop. In some cases planting is done, while in others natural regeneration is effected by protecting the seedlings that spring up under the shelter-trees. Under all of these systems nature's methods, such as we may see illustrated in any of our native forests, is either copied or slightly modified.

In a natural forest, seeds which fall from mature trees often fail to germinate owing to the want of light. If, however, a large tree is blown over, a gap is made through which the light can penetrate to the ground, with the result that any seeds that may be on the ground germinate, and gradually grow up to take the place of the fallen tree. In a forest of this kind we find trees of all ages, from the seedling to the adult stage. In an artificial forest, nature's methods are assisted by the removal of trees and the protection of any seedling that spring up. Several methods are adopted to assist the natural regeneration of forests, but in every system seed-bearing trees must be left so as to insure a crop of seedlings to take the place of any trees that are removed. The system of selection by single trees, which most resembles nature's method, is not entirely satisfactory, because the removal of a single tree may not give sufficient light for the proper development of the seedlings. Again, the removal of large-sized trees through an uneven-aged forest, besides being costly, causes much damage to the growing stock. This system, more than any other, assures the protection of the soil, and is admirably adapted for forests where the protection of the soil is of paramount importance, such as catchment-areas for reservoirs, or the sources of streams which supply power for manufacturing. If instead of removing single trees to allow of natural regeneration by seed, trees throughout a whole compartment are removed evenly, in sufficient numbers to permit of the growth of seedlings, the work, being more concentrated, does not require so much skill, nor is it as costly. On the other hand, the disadvantages of this system are that seed-bearing trees may not be evenly distributed over the area to be restocked, and, consequently, an uneven growth of seedlings results, which can only be rectified by planting up the barren portions. In forests that are composed of more than one species in mixture, and it is desired to perpetuate each species in certain proportions, it may happen that one species may seed better than another, thus making it difficult to preserve the mixture in due proportions. Under this system a failure in getting a good crop of seedlings would probably leave the land unprotected too long, thus causing deterioration in the humus and a cessation of growth in the standing trees. The compartment system may be modified by regenerating the forest in strips instead of large compartments. By this method smaller portions are taken in hand, and thoroughly regenerated before another strip is prepared. When the whole block has been treated in this manner it is composed of strips of trees of varying ages.

Natural regeneration can also be effected by what is known as the "group system." Groups of seed-bearing trees are selected at points throughout the forest. These are thinned to allow of the germination of the seed, and when regeneration has been accomplished contiguous portions of the forest are taken in hand and dealt with in a similar manner. Thus the radius of each regenerated group gradually increases until one group merges into another group. This process is repeated until the whole of the forest has been regenerated, with the result that the area is stocked with groups of trees of varying ages. Under this system the soil on the areas thinned gets the protection of the surrounding dense forest, and currents of air are not so harmful as under the compartment or strip system. Another advantage is that the shelter-trees can be removed across land that has not been regenerated, and thus no young stock is damaged, and the work is thereby rendered much easier.

All of the systems which have been briefly described are capable of being modified to suit the special requirements of a locality. For instance, if timber of extra large size is required, some of the shelter-trees over an area regenerated by seed may be left to grow until the young crop is ready to cut. Species that are tender in their young state could be planted under the shelter-trees, instead of allowing the natural regeneration of the shelter species. This system is especially suitable for growing the broad-leaved species in districts where the frost damages their growth.

Seed-supplies.—The question of seed-supplies has in a great measure determined the species of trees that have been selected for extensive cultivation in our plantations. The seed-merchants of Europe and America deal especially in the species of trees that are used in afforestation work in the Northern Hemisphere, hence these are the only kinds that can be procured cheaply, and in fairly large and regular quantities. Many of the trees we have tried are well adapted for extensive cultivation here, but the uncertainty of getting supplies, and the high cost of the seed, rendered the extensive cultivation of them impossible. Imported tree-seeds are usually low in

vitality, because they are really a year old before they reach us. The following table shows the average number of trees of several of the principal species raised per pound of seed for a period of five years at Rotorua Nursery. The cost per thousand is estimated only from what the seed cost, and does not include the cost of growing. This is merely intended to give an idea of how the cost of the seed influences the proportions of the several species grown :—

Name of Species.	Average Number of Trees raised from 1 lb. of Seed.	Average Cost of Seed for One Thousand Trees.	Remarks.
		s. d.	
Larix europaea	3,500	0 7·87	Imported from Europe.
Pinus austriaca	4,300	0 11·63	,, ,,
,, Laricio	5,500	0 7·33	,, ,,
,, ponderosa	3,200	3 4	,, America.
,, strobus	2,000	6 1	,, ,,
,, radiata	11,000	0 3·37	Seed saved in New Zealand.
Pseudo-tsuga Douglasii	5,400	2 5½	Imported from America.
Sequoia sempervirens	1,200	12 7	,, ,,
Eucalyptus Stuartiana	24,500	0 3½	,, Australia.
,, pauciflora	14,500	0 5¼	,, ,,
,, amygdalina	24,500	0 2½	,, ,,

Seeds of many of the American species can be procured in Europe at rates considerably lower than those charged by American firms; but, on the other hand, the quality of the seed is much lower, so that it is cheaper in the end to get these direct from America. The formation of forests by direct sowing, instead of planting, is practised to a certain extent where the conditions are favourable in the Northern Hemisphere. To do this profitably, however, cheap and good seed is absolutely necessary, and, besides, the conditions must be especially favourable. These conditions it is not proposed to discuss, as such a method of forming forests in New Zealand is quite unthinkable, on account of the cost of the seed. Sowing the seeds in nurseries, and caring for every seedling thus raised, is the only profitable method we can adopt until seeds of the several species are saved in New Zealand, and their cost much lower than at present.

Summary.—Since afforestation work was commenced in the Rotorua District some twelve years ago, much information has been gained with respect to this subject. Much of the work in the first place was necessarily of an experimental nature, but the experience that has been gained from the operations up to the present time has made it possible to arrange the various species with much precision with respect to both soil and aspect.

Although the information gained is far from complete enough to lay down a decided course for a long period, yet it is sufficient to guide our operations for, say, the next ten years, by which time further data will have been collected, and a choice of system or systems made possible. Up to a certain point all the systems have much in common, so that the choice of any is not really an urgent matter, considering the limitations to the number of species that can be successfully grown. Owing to the damage done by frost to certain species one thing is certain: we must cover the ground with whatever sort will succeed, and the species that do this in the quickest manner should be favoured, inasmuch as the introduction of the less hardy species will be the sooner possible. The information gained from the work up to the present may be summarised as follows:—

1. Broad-leaved trees, such as oak, ash, catalpa, &c., have failed owing to unseasonable frosts. Some of them could be grown in small selected patches, but the method is costly, and it is deemed advisable to confine our operations to several of the conifers.

2. Damage by frost to certain species of conifers can be avoided by choosing aspects suitable for each.

3. The comparative rate of growth of the kinds has been ascertained. (Under this head much information is still required, as many species which are slow growers when young become rapid growers after they have attained a certain age.)

4. Mixtures of species are undesirable, particularly on account of the difference in the rates of growth.

5. Many species have been tried and have been found to be too tender; others are suitable, but regular supplies of their seeds cannot be procured; and a few species—principally those that find a place in the forestry operations in Europe—are suitable, and can be cheaply grown. Information about trees that have been tried can be got by referring to the tables appended hereto.

Information on the following lines will be collected as time goes on :—

1. Suitability of species to the soil and locality. This refers more to those kinds that have failed owing to frost, but which may be suitable for planting as under-trees.

2. Development of trees. Data is required as to when the species complete their principal height-growth. The extent of the annual accretions is also a necessity in forecasting the value of a crop, and a help in deciding the period of rotation.

3. The ages at which the different species commence to bear seed, and the frequency of the seed years. Such information as this is needed if one of the systems of natural regeneration is adopted.

4. The kinds of timber that are required to meet the demands of the market. Timbers for general construction purposes are, of course, always in demand. Many other industries, however, require special kinds of timber, and these should be anticipated.

5. Diseases and insect-pests. So far there has been very little damage done to any of the plantations by disease or insects. These, however, are sure to come, and must be watched and dealt with as occasion demands.

6. Period of rotation. In forestry this term is used to denote the period between the formation of a forest and a final cutting. The period of rotation may be determined on either of the following lines:—

(*a.*) The object for which the timber is grown. This means that the timber is allowed to grow until it is a suitable size for a special purpose, without considering the financial aspect.

(*b.*) The period which best suits the natural reproduction of the trees.

(*c.*) The financial aspect. The quantity of timber formed annually in a forest may be fairly regular up to a certain period, after which the increase of timber gradually declines. Suppose, for instance, the investment is required to pay interest at the rate of 4 per cent. At a certain period the crop may yield the required interest; if cut before or after that period the interest would be less. Coppice forests, being worked on a short rotation, give a quick return, but the value of the produce would probably only yield a small interest on the capital invested. The production of very large timber requires a long rotation period, and if the capital invested is multiplied by the years of rotation, plus compound interest, the interest yielded may be very low.

Provision is being made for collecting all information that will assist towards making the plantations a success, both physically and financially, and as a start in this direction the enclosures are being subdivided, and plans of reference being prepared. Each compartment is being given a distinguishing number, and records of trees planted and all work done on each compartment is being kept.

Choice of a System.—The climatic conditions of the Rotorua District have left us little choice in manner of conducting the work of afforestation. As regards the choice of species, the hardiest kinds have been necessary, and of these the species producing the most valuable timber have been chosen. Although mixtures of species were planted at first, latterly all the species have been planted pure. This, so far, is all right, the land has been covered, the soil is being protected, and a condition absolutely necessary for the production of timber created. As most of the species planted, however, are light-demanding, there will come a time when they will fail to give the requisite amount of protection to the soil, and it is when this period arrives that a further choice of species and a system will become necessary. The question then arises, What system is the best to adopt? If the production of small-sized timber would meet the demands of the market, then in most cases a system of clear cutting could be adopted. Small-sized timber would, however, be hard to dispose of in New Zealand, and it is therefore apparent that some other system must be chosen. The species that have been planted are not suitable for a uniform system, so that each class will be mentioned separately.

Larch.—This species occupies more than half of the area that has been planted. It is extremely light-demanding, and, in this respect, does not protect the soil to an advanced age. If we consulted the best authorities on sylviculture they would probably advise that the common beech (*Fagus sylvatica*) is the best species to mix with larch, either when the plantation is formed or when the larch thins out, by underplanting. Two difficulties stand in the way of carrying this method out. First, beech-seed cannot be procured in New Zealand, and will not carry from Europe; and, second, larch would kill out beech or any other tree planted along with it, owing to its fast growth. In Europe, larch is not now planted pure, owing to the prevalence of the larch disease, a trouble that can only be ameliorated by mixing another species along with the larch. This disease, so far, is unknown in New Zealand; but as it has such a disastrous effect on the larch, it seems common prudence to take measures to prevent it as long as possible, as well as to give it the least number of chances to spread if it should occur. This could be done by thinning the larch severely at an early age—about the twelfth to fifteenth year—and introducing another species by planting this under the larch that are left on the area. For this purpose the Oregon pine, Sitka spruce, probably the redwood, and *Thuja plicata* would be suitable. If, on the other hand, the liability of a disease affecting the larch is left out of the question, the plantations should be sparingly thinned as occasion demands, and then, when the crowns are too far apart to protect the soil, underplanting could be done with the above-mentioned species.

The period at which larch or any of the other light-demanding species open out depends on many circumstances, and in different districts it may vary considerably. On this point much information is still required, and this information can only be got by observations of our plantations as they gradually become older.

Pinus Laricio and Pinus ponderosa.—The former species, next to larch, is the one most extensively grown at the plantations. *Pinus ponderosa*, perhaps, comes next in the conifer class, but both species have been bracketed together, as it is probable that the same sylviculture system will be suitable for both. Our observations up to the present reveal the fact that both these species require a fair amount of light, and, consequently, space to allow of their proper development. Just how long it will be advisable to allow them to remain in pure plantations is as yet unknown, and cannot yet be determined. Timber of a suitable size may be produced in pure plantations, but, if not, a system of underplanting will have to be resorted to.

Pinus Austriaca, Pseudo-tsuga Douglasii, and Pinus Strobus.—Each of these species stand more shade than the ones previously described. It is probable that these will protect the soil sufficiently to an advanced age, and that a system of natural regeneration could be adopted.

Eucalypti.—None of our plantations of these trees are sufficiently advanced to make it possible to give a definite opinion as to the proper sylviculture system to adopt, but it is probable that the group system of natural regeneration will be found to be the most suitable.

TREE-GROWING IN THE WHANGAREI DISTRICT.

After, and sometimes before, the sawmillers take the millable timber from a forest area, a fire sweeps over the land, destroying the natural growth, and, what is of infinitely more importance, the forest-floor, which has been accumulating perhaps for centuries. Such land at first takes well with grass, but on hilly country this disappears in a few years, owing to the rain washing off the soil, the deterioration of the humus from exposure, and the tracks worn by cattle. It is quite a common thing to see hillsides that have been denuded of tree-growth with cattle-worn tracks running diagonally across them. These tracks are usually worn into the subsoil, and between each track is a weak growth of grass, holding together the remains of the humus which at one time must have covered the whole of the land. Land such as this has simply been ruined, and the plantation at Puhipuhi has many acres answering this description. In the wet season the rain, instead of soaking into the soil, runs off the surface into the lower levels, and in the dry weather it becomes parched and cracked. To grow trees, or, in fact, almost any crop, on land of this nature without first ploughing it is a difficult undertaking.

On level land or on slopes with an easy grade much of the humus has been saved by a dense growth of bracken, which protects the soil from the sun and driving rain. Here, again, is a difficulty in growing such species as have been tried at Puhipuhi.

Insects, too, amongst the bracken are very numerous, and large numbers of trees have been injured by them. A small moth which obtains its sustenance from the green part of the bracken has found an equally generous host in many species of eucalypti. Locusts also cause much damage.

There are many areas of land in New Zealand which, owing to their steep nature and inaccessible position, should never have been denuded, and there are still such areas that should be reserved for all time. Where land is liable to become absolutley worthless if the natural growth is removed, the valuable timber could be extracted and the smaller growth protected to save the soil. Such precautions are indispensable on hills where a stream of water which supplies power for manufacturing purposes has its source.

The natural regeneration of our best timber trees may be unprofitable when we consider the length of time these trees take to mature, but surely it would pay to save the natural water-power in many districts, and also to keep the land from deteriorating and becoming absolutely worthless. A reserve of this nature could be gradually stocked with exotic trees of a quicker growth than our native trees, and although the work in the first place would cost more than similar work on cleared land, yet such work has a value beyond the mere market value of the timber that would be produced. It would be probably cheaper in the long run to introduce exotic timber trees by grouping them amongst the valueless native growth than by allowing the land to be denuded before planting commenced, because the resultant growth of the planted trees would be quicker where the soil conditions are congenial than on land where the soil has been eroded.

The general remarks that I have made explain the position of affairs at Puhipuhi. On land that had once been heavily stocked with timber, but had been cleared with the axe and fire, experiments were made by planting the native totara and a number of the most useful eucalypti, such as red-gum, jarrah, ironbark, &c. Other trees such as Oregon pine, Sitka spruce, and walnut were also tried, but with poor results. The experiments show that the *Eucalyptus Stuartiana* is the most suitable species in this class, *E. resinifera* next, then *E. rostrata*. *Pinus muricata* succeeded, but the other species of trees mentioned were a complete failure. The cause of the failures was owing to the conditions necessary for the growth of trees having been destroyed by the removal of the natural forest, and the subsequent deterioration of the humus by sun, wind, and rain. Very few species will adapt themselves to such conditions, and under these conditions forestry operations are not likely to be a financial success. The primary object in commencing tree-growing in this district was to experiment with our native totara. This is a very valuable species, and in cultivation it grows perhaps quicker than any other of our native taxads. No difficulty was experienced in getting seeds of this tree, and the crops of seedlings raised each year in the Ruatangata Nursery made better growth than any exotic conifer I know of except the larch, and in comparison with that species the growth made by the totara is not far behind. The raising of seedling totara then presented no difficulties, but when the young trees were planted at Puhipuhi under the conditions previously described they simply came to a standstill, or died off during the first spell of dry weather. It is quite evident that the totara has not the power to accommodate itself to such conditions. This same difficulty is met with in growing many valuable species of exotic trees, and instances of this are given in the report on tree-growing in the Rotorua District. Some trees will not grow without the protection of a hardier species, and totara is particularly demanding in this respect. To grow it successfully, a cover crop of a hardier species should first be grown, and when this crop has properly covered the soil, it should be thinned to allow of the introduction of the totara.

It has already been said that certain lands should never be entirely denuded of forest growth. Now, suppose a thin growth of small native trees is left after the removal of any timber of a millable size, why not use this as a cover crop for growing a more valuable species, instead of having to face the numerous difficulties in the way of growing trees on land that has been destroyed by erosion? Tree-planting amongst native growth is, of course, necessarily expensive, but the time will surely come when it will be found necessary to plant such land with trees, and why not do it before the humus is destroyed? Agricultural pursuits and forestry operations should proceed side by side. Let us at once distinguish between land that is useful for farming and land that would be destroyed if the forest growth is removed. Reserve the latter for all time after taking out the valuable timber; gradually introduce a timber tree by planting as time and funds permit, but never let the land be entirely denuded. In this manner some return in the way of timber will be got from such a reserve, and, in addition to that, many such reserves will have a value that could not be computed in this way.

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